THE

WONDERS OF THE OCEAN;

CONTAINING

AN ACCOUNT

OF THE

COLOR, SALTNESS, AND PROBABLE DEPTH OF THE OCEAN; OF ITS MOUNTAINS OF ICE, GULFS, WHIRLPOOLS, CURRENTS, AND TIDES;

AND OF ITS

CORAL AND OTHER FORMATIONS AND PRODUCTIONS,

SO FAR AS KNOWN,

WHETHER ANIMAL, MINERAL, OR VEGETABLE.

COMPILED BY

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"Likeness of Heaven! Agent of Power!
Man is thy victim, Shipwrecks thy dower!
Spices and jewels from valley and sea,
Armies and banners are buried in thee!"

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PREFACE.

The inspired penman said the way of God was in the sea, and that his footsteps were unknown. The leading sentiment of this declaration is, that the ocean is one of the vast theatres in which He displays his wisdom and power; and yet, that He can no more be traced therein, than can be seen the footsteps of a man who might walk upon the surface of the water. This is true of the Divine operations generally in the material universe; but in the deep ocean, which lies concealed from human vision, it is peculiarly true.

Let us in imagination place ourselves on board a ship about mid ocean. It is midnight, and fearfully dark. Not a star is seen. A tempest with tremendous fury sweeps over the wide expanse. Wave succeeds wave, like rolling mountains, each rising higher than the preceding one. Clinging to the rigging, we stand in amazement. The winds howl, and fill us with terror; and we shudder, lest, at the next plunge of our shivering barque, we become buried amid the mighty billows. True, a calm relieves us from peril, and we are safe. Here has been one of the most sublime spectacles of the ocean ever witnessed; yet how little have we seen, or do we hence know of the uncounted treasures and mysterious workings of her unexplored regions! We have never looked down into her unfathomable depths. We know but a little of what they contain. We have seen a few of her gigantic animals,

and have had vague accounts of others more monstrous than those we have seen. And the presumption is, there may be others more hideous and frightful than even the latter.

Now if the waters of the ocean were to be suddenly removed; and if its deep and unmeasured caverns were to be laid open to the examination of earth's inhabitants, what a host of marvellous things would meet the eye! Were we to suppose that the thousands, and the tens of thousands, and the hundreds of thousands of those huge and monstrous animals could be gathered together in promiscuous crowds and heaps, all alive and struggling with their mighty energies for life and for liberty, what an exhibition would be presented! And suppose all the ships that have, in all ages of the world, been buried underneath her waves, were to be arranged in an erect posture, on some ocean pampas, would they not appear like a wide forest, and would they not be sufficient for the commerce of the entire world! And, if all the bones of all the human beings that have in all ages of the world been lost in the briny deep, were to be spread out on its surface, would they not whiten a whole continent! And are there not too, in those ocean regions, whole cities with their dwellings, and warehouses, and workshops, and churches, and palaces, sunk amid nature's convulsions from their original elevation, and buried by the gushing waters which have filled up the chasm over them!

EDITOR.

NEW YORK, *August 2d*, 1845.

INTRODUCTION.

What a wonder is the ocean! How wide does it stretch out its arms, clasping islands and continents in its embrace! How mysterious are its depths!—still more mysterious its hoarded and hidden treasures! With what weight do its watery masses roll onward to the shore, when not a breath of wind is moving over its surface! How wonderfully fearful is it, when its waves, in mid ocean, are foaming and tossing their heads in anger under the lash of the tempest! How wonderfully beautiful, when like a melted and ever-moving mirror, it reflects the setting sun, or the crimson clouds, or the saffron heavens, after the sun has set; or when its "watery floor" breaks into myriads of fragments the image of the quiet moon that falls upon it from the skies!

Wonderful, too, are those hills of ice that break off, in thunder, from the frozen barriers of the pole, and float towards the sun, their bristling pinnacles glistening in his beams, and slowly wasting away under his power, an object at once of wonder and of dread to the mariner, till they are lost in the embrace of more genial deeps. And, that current is a wonder, which moves forever onward from the southern seas, to the colder latitudes, bearing in its waters the influence of the tropical sun, and saying to the icebergs from the pole, "Hitherto may ye come, but no farther." And, if possible, still more wonderful are those springs of fresh water, which among Indian Isles gush from the depths of a salt ocean, a source of refreshment and life to the seaman who is parching with thirst beneath a burning sky.

And is it not as wonderful, when, not a spring of fresh

water, but a column of volcanic fire shoots up from "the dark unfathomed caves of ocean," and throws its red glare far over the astonished waves, that heave and tremble with the heaving and trembling earth below them! wonderful, when that pillar of fire vanishes, leaving a smoking volcano in its place! and wonderful, when that volcano, in its turn, sinks back and is lost in the depths whence it rose!

Then there are other wonders in the living creatures of the deep, from the animalcule, that "no eye can see," and that scarcely "glass can reach," up to "that Leviathan which God hath made to play therein." In "this great and wide sea are things creeping innumerable, both small and great beasts." Yet He, who hath made them all, even there openeth his hand and satisfieth the desires of all. Wonderful is it, that, of these "creatures innumerable," each one finds its food in some other, and, in its turn, serves some other for food; and that this great work of destruction and reproduction goes on in an unbroken circle from age to age, in the deep silence of those still deeper waters where the power of man is neither felt nor feared!

What a wonder, too, is that line of phosphoric light, which, in the darkest night, streams along the way of a ship in the midst of the sea! What is it that gives out this fire, which, like that of love, "many waters cannot quench, neither can the floods drown it?" Theorists may speculate, naturalists may examine, chemists may analyze; but none of them can explain; and all agree in this, that it is a wonder, a mystery, a marvel. A light that only motion kindles! a fire that burns nothing! a fire, too, seen, not in a bush on Horeb, which *is* not burned, but in the deep waters of the ocean that *cannot* be! Is not this a wonder?

And, if that path of light is a wonder, which streams back from the rudder of a ship, is not that ship itself a wonder? That a fabric so gigantic as a first-rate ship, of traffic or of war, framed of ponderous timbers, compacted with bolts and bands of still more ponderous iron, holding

in its bosom masses of merchandise, under whose weight strong cars have groaned, and paved streets have trembled, or bearing on its decks hosts of armed men, with the thundering armament of a nation,—that a fabric thus framed and thus freighted, should float in a fluid, into which, if a man fall, he sinks and is lost, is in itself a wonder. But, that such a fabric should traverse oceans, struggling on amid the strife of seas and storms, that it should hold on its way like "a thing of life," nay, like a thing of intellect, a being endued with courage, and stimulated by a high purpose, a traveller that has seen the end of his voyage from the beginning, that goes forth upon it without fear, and completes it as with the feeling of a triumph, is, as it seems to me, a greater wonder still.

Let me ask you to stand, as you perhaps have stood, upon the deck of such a ship,

"In the dead waist and middle of the night,"

now in the strong light of the moon, as it looks down upon you, between the swelling sails, or now in the deep shadow that the sails throw over you. Hear the majestic thing that bears you, breasting and breaking through the waves that oppose themselves to her march! She is moving on alone, on the top of the world, and through the dread solitude of the sea. Nothing is heard, save, perhaps, the falling back of a wave, that has been showing its white crest in the moon, or, as your ship is ploughing her way, the rushing of the water along her sides. Yet she seems to care for all that she contains, and to watch, while they sleep as sweetly in her bosom as in their own beds at home; and, though she sees no convoy to guard her, and no torch-bearer to guide her, she seems as conscious that she is safe, as she is confident that she is going right. Is not all this a wonder?

But there is at hand another wonder yet, the mysterious but faithful index that points the seaman's way through the great waters. The magnetic needle, what a wonder, what a miracle is that! By night as truly as by day, in storm as fearlessly as in calm, in winter and in summer

alike, this incorruptible and faithful friend may be consulted with more confidence than any human counsellor, than any pagan oracle, by him who is doubtful of his course; and, under its guidance the wayfarer of the deeps, though a fool, need not err therein.

What does not the civilized world owe to this single wonder! We may now truly say, in the words of the Wisdom of Solomon, It is "thy Providence, O Father, that hath made a way in the sea, and a safe path through the waves, showing that thou canst save from all danger, yea, though a man went to sea without art." It is this little piece of iron, imbued with this mysterious power, that binds together the nations of the earth more firmly than they could be bound "by bars of brass and ribs of steel;" for it shows them their common dependence, and it unites them by the ties of mutual benefits. It is this, that, under the fostering care of commerce, has borne the Gospel to the distant isles of the sea, and caused the day-star of an immortal hope to rise upon the hearts of millions, who had before been sitting in darkness, as deep and more dreadful than the shadow of death.

PIERPONT.

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WONDERS OF THE OCEAN.

GENERAL VIEW OF THE OCEAN.

Thou glorious mirror, where the Almighty's form
Glasses itself in tempests; in all time,
Calm or convulsed—in breeze, or gale, or storm,
Icing the pole, or in the torrid clime
Darts heaving;—boundless, endless, and sublime—
The image of Eternity—the throne
Of the Invisible; even from out thy slime
The monsters of the deep are made; each zone
Obeys thee; thou goest forth, dread, fathomless, alone.

BYRON.

ALTHOUGH the ocean, properly speaking, is but one extensive sheet of water, continued over every part of the globe without interruption; and although no part of it is divided from the rest, yet geographers have distinguished it by different names; as the Atlantic, or Western ocean, the Northern, Southern, Pacific, Indian, and German oceans.

In this vast receptacle, almost all the rivers of the earth ultimately terminate. And yet these vast and inexhaustible supplies do not seem to increase its stores; for it is neither apparently swelled by their tribute, nor diminished by their failure; it continues constantly

the same. Indeed, the quantity of water of all the rivers and lakes in the world is nothing, compared to that contained in this prodigious reservoir. And some natural philosophers have carried their ideas on this subject so far, as to assert, in consequence of certain calculations, that if the bed of the sea were empty, all the rivers of the world flowing into it with a continuance of their present stores, would take up at least eight hundred years to fill it again to its present height.

Thus great is the assemblage of waters diffused round our habitable globe ; and yet, immeasurable as it seems, it is rendered subservient principally to the necessities and conveniences of so little a being as man. Some have perceived so much analogy to man in the formation of the ocean, that they have not hesitated to assert it was made for him alone. This has been denied by others ; and a variety of arguments have been adduced on both sides, into which I do not think it necessary to enter here ; for, of this we are certain, that the great Creator has endowed us with abilities to turn this great extent of waters to our own advantage. He has made these things, perhaps, for other uses; but he has given us faculties to connect them to our own. This much-agitated question, therefore, seems to terminate here ; we shall never know whether the things of this world were made for our use, but we very well know that we were made to enjoy them.

Let us then boldly affirm, that the earth and all its wonders are ours; since we are furnished with powers to force them into our service.

Man is the lord of the whole sublunary creation; the howling savage, the winding serpent, with all the untameable and rebellious offspring of nature, are destroyed in the contest, or driven at a distance from his habitations. The extensive and tempestuous ocean, instead of dividing or limiting his power, only serves to assist his industry, and enlarge the sphere of his enjoyments. Its billows and its monsters, instead of presenting a scene of terror, serve only to excite and invigorate the courage of this intrepid little being; and the greatest danger that man now fears from the deep, is from his fellow-creatures. Indeed, if we consider the human race as nature has formed them, very little of the habitable globe seems to be made for them. But when they are considered as accumulating the wisdom of ages, in commanding the earth, there is nothing so great, nor so terrible. What a poor contemptible being is the naked savage, standing on the beach of the ocean, and trembling at its tumults! How incapable is he of converting its terrors into benefits; or of saying, "Behold an element made solely for my enjoyment!" He considers it as an angry deity, and pays it the homage of submission. But it is very different when he has exercised his

mental powers, when he has learned to find his own superiority, and to make it subservient to his commands. It is then that his dignity begins to appear, and that the true Deity is adored, for having been mindful of man, for having given him the earth for his habitation, and the sea for his inheritance.

APOSTROPHE TO THE OCEAN.

HAIL! thou inexhaustible source of wonder and contemplation! Hail! thou multitudinous ocean! whose waves chase one another down like the generations of men, and after a momentary space are immerged forever in oblivion! Thy fluctuating waters wash the varied shores of the world, and while they disjoin nations, whom a nearer connection would involve in eternal war, they circulate their arts and their labors, and give health and plenty to mankind. How glorious! how awful are the scenes thou displayest! Whether we view thee when every wind is hushed,—when the morning sun, as now, silvers the level line of the horizon, or when its evening track is marked with flaming gold, thy unrippled bosom reflects the radiance of the overarching heavens! or whether we behold thee in thy terrors, when the black tempest sweeps thy swelling billows, and the boiling surge mixes with the clouds,—when death rides the

storm, and humanity drops a fruitless tear for the toiling mariner, whose heart is sinking with dismay. And yet, mighty deep, 'tis thy surface alone we view. Who can penetrate the secrets of thy wide domain? what eye can visit thy immense rocks and caverns, that teem with life and vegetation; or search out the myriads of objects, whose beauties lie scattered over thy dread abyss? The mind staggers with the immensity of its conceptions; and when she contemplates the flux and reflux of thy tides, which from the beginning of the world were never known to err, how does she shrink at the idea of that Divine Power, which originally laid thy foundations so sure, and whose omnipotent voice hath fixed the limits where thy proud waves shall be stayed!

DEPTH OF THE OCEAN.

As to the bottom of the basin of the sea, it seems to have inequalities similar to those which the surface of continents exhibits; if it were dried up, it would present mountains, valleys, and plains. It is, moreover, inhabited almost throughout its whole extent by an immense quantity of testaceous animals, or covered with sand and gravel. It was thus that Donati found the bottom of the Adriatic Sea; the bed of testaceous animals there, according to him, is several hundred feet in thickness. The celebrated diver, Pescecola, whom the

Emperor Frederick II. employed to descend into the strait of Messina, saw there, with horror, enormous polypi attached to the rocks, the arms of which, being several yards long, were more than sufficient to strangle a man. In a great many places, the madrepores form a kind of petrified forest fixed at the bottom of the sea, and frequently too, this bottom plainly presents different layers of rocks and earth.

The granite rises up in sharp-pointed masses. Near Marseilles, marble is dug up from a submarine quarry. There are also bituminous springs, and even springs of fresh water, that spout up from the depths of the ocean; and in the Gulf of Spezia, a great spout or fountain of fresh water is seen to rise like a liquid hill. Similar springs furnish the inhabitants of the town of Aradus with their ordinary beverage.

On the southern coast of Cuba, to the southwest of the port of Batabano, in the bay of Xagua, at two or three miles from the land, springs of fresh water gush up with such force in the midst of the salt, that small boats cannot approach them with safety; the deeper you draw the water the fresher you find it. It has been observed, that in the neighborhood of steep coasts, the bottom of the sea also sinks down suddenly to a considerable depth, whilst near a low coast, and one of gentle declivity, it is only gradually that the sea deepens.

There are some places in the sea where no

bottom has yet been found. But we must not conclude that the sea is really bottomless; an idea which, if not absurd, is at least by no means conformable to the analogies of natural science. The mountains of continents seem to correspond with what are called the abysses of the sea; but now the highest mountains do not rise to 20,000 feet. It is true, that they have been wasted down and lessened by the action of the elements; it may, therefore, be reasonably concluded, that the sea is not beyond 30,000 feet in depth; but it is impossible to find the bottom even at one third of this depth with our little instruments. The greatest depth that has been tried to be measured, is that found in the Northern Ocean by Lord Mulgrave; he heaved a very heavy sounding lead, and gave out along with it cable-rope to the length of 4680 feet, without finding the bottom.

EXTENT OF THE OCEAN.

Buffon supposed that the surface of our globe is equally divided between land and water, and has accordingly calculated the superficies of the sea to be 85,490,506 square miles. But it is well known that the ocean covers much more than half of the earth's surface. Buffon believed the existence of a vast southern continent, which Captain Cook has

shown to be visionary. It was this circumstance which misled him. According to the most accurate observations hitherto made, the surface of the sea is to that of the land as three to one; the ocean, therefore, extends over 128,235,759 square miles, supposing the superficies of the whole globe to be 180,981,012 square miles.

To ascertain the depth of the sea is still more difficult than its superficies; both on account of the numerous experiments which it would be necessary to make, and the want of proper instruments for that purpose. Beyond a certain depth the sea has hitherto been found unfathomable; and though several very ingenious methods have been contrived to obviate this difficulty, none of them has completely answered the purpose. We know in general that the depth of the sea increases gradually as we leave the shore; but if this continued beyond a certain distance, the depth in the middle of the ocean would be prodigious. Indeed, the numerous islands everywhere scattered in the sea demonstrate the contrary, by showing us that the bottom of the water is unequal, like the land; and that, so far from uniformly sinking, it sometimes rises into lofty mountains.

If the depth of the sea is in proportion to the elevation of the land, as has generally been supposed, its greatest depth will not exceed five or six miles, for there is no mountain six

miles perpendicular above the level of the sea. The sea has never been actually sounded to a greater depth than a mile and 66 feet; every thing beyond that therefore rests entirely upon conjecture and analogical reasoning, which ought never to be admitted to determine a single point that can be ascertained by experiment, because, when admitted, they have too often led to false conclusions. Along the coasts, where the depth of the sea is in general well known, it has always been found proportioned to the height of the shore: when the coast is high and mountainous, the sea that washes it is deep; when, on the contrary, the coast is low, the water is shallow. Whether this analogy holds at a distance from the shore, experiments alone can determine.

To calculate the water contained in the sea, while its depth is unknown, is impossible. But if we suppose with Buffon that its medium depth is the fourth part of a mile, the ocean, if its superficies is 128,235,759 square miles, will contain 32,058,939.75 cubic miles of water.

Let us now endeavor to compute the quantity of water which is constantly discharged into the sea. For this purpose let us take a river whose velocity and quantity of water are known: the Po, for instance, which, according to Riccoli, is 1000 feet (or 100 perches Boulogne) broad, ten feet deep, and runs at the rate of four miles in an hour; consequently that river discharges into the sea 200,000 cubic

perches of water in an hour, or 4,800,000 in a day. A cubic mile contains 125,000,000 cubic perches, the Po therefore will take 26 days to discharge a cubic mile of water into the sea.

Let us now suppose, what is not perhaps very far from the truth, that the quantity of water which the sea receives from the rivers in any country is proportioned to the extent of that country. The Po, from its origin to its mouth, traverses a country 380 miles long, and the rivers which fall into it on every side rise from sources about 60 miles distant from it. The Po, therefore, and the rivers which it receives, water a country of 45,600 square miles. Now, since the land on our globe amounts to 42,745,253 square miles, it follows, from our supposition, that the quantity of water discharged by all the rivers in the world in one day is 36 cubic miles. If, therefore, the sea contains 32,058,939 cubic miles of water, it would take all the rivers in the world 2439 years to discharge an equal quantity.

It may seem surprising that the sea, since it is continually receiving such an immense supply of water, does not visibly increase, and at last cover the whole earth. But our surprise will cease, if we consider that the rivers themselves are supplied from the sea, and that they do nothing more than carry back those waters which the ocean is continually lavishing upon the earth. Dr. Halley has demonstrated that the vapors raised from the sea and transported

upon land are sufficient to maintain all the rivers in the world. The simplicity of this great process is astonishing: the sea not only connects distant countries, and renders it easy to transport the commodities of one nation to another, but its waters rising in the air descend in showers to fertilize the earth and nourish the vegetable kingdom, and collecting into rivers flow onward, bringing fertility and wealth and commerce along with them, and again return to repeat the same round.

SALTNESS OF THE OCEAN.

The cause of the saltness of the ocean has been a subject of investigation among philosophers in almost all ages, but it still remains in great obscurity. There can be little doubt that a large quantity of saline matter existed in this globe from the creation; and at this day, we find immense beds of sal gem, or common salt, buried in the earth, particularly at Cracow; but whether these collections have been derived from the ocean, and deposited in consequence of the evaporation of its waters in certain circumstances; or whether the ocean was itself originally fresh, and received its salt from collections of saline matter situated at its bottom, or from that brought by the influx of rivers, cannot now be ascertained.

No accurate observations on the degree of

saltness of the ocean in particular latitudes were made till the present century, and it is not possible, therefore, to ascertain what was the state of the sea at any considerable distance of time, nor, consequently, whether its degree of saltness increases, decreases, or is stationary. From differences among aquatic animals, however, some of which seem adapted to salt water, and some to fresh, it is probable that both these states of water existed from the creation of the world. We know, it is true, that some kinds of fish, as salmon, are capable of existing both in fresh and in salt water, and that habit has a powerful influence over all animals; but this is not sufficient to refute the main fact, that some kinds of fish thrive only in salt water, others in fresh; some in standing pools, others in rapid currents.

Sea-water may be rendered fresh by freezing, which excludes or precipitates the saline particles; or by distillation, which leaves the salt in a mass at the bottom of the vessel. Upon these principles, a mode of obtaining a supply of fresh water at sea was recommended some years ago to the English admiralty by Dr. Irving. It consisted in only adapting a tin tube of suitable dimensions to the lid of the common ship's kettle, and condensing the steam in a hogshead which served as a receiver. By this mode a supply of twenty-five gallons of fresh water per hour might be obtained from the kettle of one of our ships of war.

The saline taste of sea-water is chiefly derived from common salt, which it holds in solution. Sea-water is also distinguished by a nauseous bitter taste, which is ascribed to the animal and vegetable matters which are floating in it. This taste has been considered as in some measure foreign to it, for it is only found in the water on the surface of the ocean, or near the shores. Sea-water, taken up at considerable depths, contains only saline matters.

Sea-water experiences great changes from the agitation of the waves, from the variations of seasons, and from the action of the currents. Near Walloe, in Norway, where there is a salt-pit, it has been remarked, that the sea-water taken at the surface contains one twenty-fourth of its weight of salt at the moment the ice is detached, which extends thirty feet down; while the salt in every other season is in the proportion only of one-thirtieth. Upon the coasts of Cumberland, in England, a still stronger evaporation is experienced, as there is generally one forty-fifth of salt in the sea-water, which is sometimes reduced by excessive rains to one-fiftieth. Upon the coast of Malabar, the sea-water sometimes becomes drinkable.

In the Sound, the waters change their weight and saltness with the winds and currents: when they come from the east the water weighs only $\frac{47}{1000}$ more than melted snow;

on the contrary, when they come from the west, it weighs $\frac{1}{1}\frac{2}{0}\frac{6}{0}\frac{}{0}$. It is supposed that in Iceland the sea is more salt during the flow than the ebb of the tide, while in the Gulf of Bothnia, it is quite the contrary; for the inhabitants know by the progressive increase of the saltness during the ebb, the moment when the flow approaches. In this gulf, the saltness of the sea is in general greater towards the winter, and less towards the summer solstice, which unquestionably arises not only from the flowing of the rivers, but also from the melting of the ice.

The saltness of the sea seems in general to be less towards the poles, than under the equator. There are, however, exceptions in certain countries, and generally in all gulfs which receive a great many rivers. Sea-water is in several places less salt at the surface than at the bottom. In the strait of Constantinople the proportion is as 72 to 62. In the Mediterranean, as 32 to 29. It has been found, says Bergmann, that in the Oeresund, the water taken at the surface, and from the depth of 5 to 20 fathoms, was in proportion to melted snow-water, as 10,047, 10,060, and 10,189 to 10,000. Water ought to be denser and heavier at a certain depth, and from the result of experiments, in which a pressure has been applied to it, equal to what it sustains 1,800 fathoms from the surface, it has been computed that at that depth it should be com-

pressed $\frac{1}{1}\frac{3}{0}\frac{}{0}$ by its own weight. Sea-water, by acquiring additional saltness, seems at a certain depth to lose its bitterness; so, at least, it appears from the observations of Sparrmann, who took up a bottle of sea-water from the depth of 60 fathoms, and found it had the taste of fresh water, in which common salt had been dissolved.

It is easier to perceive the great advantages resulting from the saltness of sea-water, than to discover its origin. Without this saltness, and without the agitation in which they are continually kept, the waters of the sea would become tainted, and would be infinitely less adapted for the motion of vessels, and probably it is to this that many of the inhabitants of the ocean owe their existence. But whence comes this saltness? Is it from beds of salt lying at the bottom of the sea? These beds themselves appear rather to consist of deposites which the sea has formed by precipitation. Does the saltness originate from the corruption of river-water?

It seems, in fact, that the fresh water which is discharged into close and stagnant lakes becomes corrupted, decomposed, and forms deposites of salt. Now, the ocean may be considered as a great lake, the common reservoir of all terrestrial waters. But in this case, it is said, that the saltness should increase from day to day. Halley, who broached this opinion, wishes that experiments were made, which

in future ages might conduce to throw light on the subject.

Several modern philosophers consider the sea as the residuum of a primitive fluid, which must have held in solution all the substances of which the globe is composed; that these mother waters having deposited all the earthy, acid, and metallic principles with which they were impregnated, there remains in their residuum (which is the present sea) some of these elementary principles too intimately combined with water to escape from it; and with respect to the bitterness of sea-waters, as it diminishes in proportion to the depth, it can arise only from the great quantity of decomposed and putrifying animal and vegetable substances which float in the ocean, and which the running waters never cease to bring into it.

As the sea covers so great a portion of the globe, we should no doubt, by exploring its bottom, discover a vast number of interesting particulars. Unfortunately, in the greater part of the ocean, this has hitherto been impossible. Part, however, has been examined; and the discoveries which this examination has produced may enable us to form some idea at least of the whole. The bottom of the sea, as might have been conjectured indeed beforehand, bears a great resemblance to the surface of the dry land, being, like it, full of plains, rocks, caverns, and mountains; some of which

are abrupt and almost perpendicular, while others rise with a gentle declivity, and sometimes tower above the water and form islands.

Neither do the materials differ which compose the bottom of the sea and the basis of the dry land. If we dig to a considerable depth in any part of the earth, we uniformly meet with rock; the same thing holds in the sea. The strata too are of the same kind, disposed in the same manner, and form indeed but one whole. The same kind of mineral and bituminous substances are also found interspersed with these strata; and it is to them probably that the sea is indebted for its bitter taste. Over these natural and original strata an artificial bed has pretty generally been formed, composed of different materials in different places. It consists frequently of muddy tartareous substances firmly cemented together, sometimes of shells or coral reduced to powder, and near the mouths of rivers it is generally composed of fine sand or gravel.

THE COLOR OF THE OCEAN.

The color of the sea varies much in appearance, but it is generally of a deep bluish green, which becomes clearer towards the coasts. This apparent color of the sea seems to arise entirely from the same causes which impart a blue shade to distant mountains, and which give the atmo-

sphere its azure hue. The rays of blue light, being the most refrangible, pass in the greatest quantity through the aquatic fluid, which, in proportion to its density and depth, makes them undergo a strong refraction.

The other shades in the color of sea-water depend on causes which are local and sometimes illusory. It is said that the Mediterranean Sea, in its upper part, has sometimes a purple tint. In the Gulf of Guinea, the sea is white, and around the Maldive islands black. The Vermeille, or Vermilion sea, near California, has received its name from the red color which it often assumes. The same phenomenon was observed at the mouth of the river Plata, by Magellan, and also in other places.

It is not impossible that a great number of certain insects may, for some time, give a reddish or whitish tint to an expanse of sea. The infusion of certain earthy or mineral substances, the nature of the soil, and other causes, may produce these appearances.

The green and yellow shades of the sea arise from marine vegetables. In some places, these vegetables have been observed to rise to the surface of the water, and cover it entirely, as between the Canary and Cape de Verde Islands, in that part of the sea which the Dutch call Kroos-zee, and the Portuguese Mare di Sargasso. This marine vegetation presents, upon a large scale, phenomena similar to the efflorescence upon lakes. In the lakes, there are

delicate water mosses covered with hair, which rise during the day to the surface of the water, and often sink beneath it during the night.

The light, or sparkling of the sea, is a magnificent and imposing spectacle. Sometimes the vessel, while ploughing her way through the billows, appears to mark out a furrow of fire; each stroke of the oar emits a light, sometimes brilliant and dazzling, at other times tranquil and pearly. These moveable lights are grouped in endless varieties. Here thousands of luminous points, like little stars, appear floating on the surface, and then, multiplying together, form one vast sheet of light. There the scene becomes more tumultuous, the refulgent waves heave up, roll, and break in shining foam. At other times, we see large sparkling bodies resembling the forms of fishes, pursuing each other, disappearing, and bursting forth anew.

MYSTERIOUS MUSIC OF THE OCEAN.

Lonely and wild it rose,
That strain of solemn music from the sea,
As though the bright air trembled to disclose
An ocean mystery.

Again a low, sweet tone,
Fainting in murmurs on the listening day,
Just bade the excited thought its presence own,
Then died away.

Once more the gush of sound,
Struggling and swelling from the heaving plain,
Thrill'd a rich peal triumphantly around,
And fled again.

O boundless deep! we know
Thou hast strange wonders in thy gloom conceal'd;
Gems, flashing gems, from whose unearthly glow
Sunlight is seal'd.

And an eternal spring
Showers her rich colors with unsparing hand
Where coral trees their graceful branches fling
O'er golden sand.

But tell, O restless main!
Who are the dwellers in thy world beneath,
That thus the watery realm cannot contain
The joy they breathe?

Emblem of glorious might!
Are thy wild children, like thyself, array'd
Strong in immortal and uncheck'd delight
Which cannot fade?

Or to mankind allied,
Toiling with wo, and passions' fiery sting;
Like their own home, where storms or peace preside,
As the winds bring?

Alas for human thought!
How does it flee existence worn and old,
To win companionship with beings wrought
Of finer mould!

'Tis vain! the reckless waves
Join with loud revel the dim ages flown,
But keep each secret of their hidden caves
Dark and unknown!

MEDITATION UPON THE SEA.

"The sea is his, and he made it," cries the Psalmist of Israel, in one of those bursts of enthusiasm and devotion in which he so often expresses the whole of a vast subject by a few simple words. Whose else, indeed, could it be, and by whom else could it have been made? Who else can heave its tides, and appoint its bounds? Who else can urge its mighty waves to madness, with the breath and the wings of a tempest; and then speak to it again in a master's accents, and bid it be still?

Who else could have peopled it with its countless inhabitants, and caused it to bring forth its various productions, and filled it from its deepest bed to its expanded surface, filled it from its centre to its remotest shores, filled it to the brim, with beauty and mystery and power? Majestic ocean! Glorious sea! No created being rules thee or made thee. Thou hearest but one voice, and that is the Lord's; thou obeyest but one arm, and that is the Almighty's. The ownership and the workmanship are God's; thou art his, and he made thee.

"The sea is his, and he made it." Its ma-

jesty is of God. What is there more sublime than the trackless, desert, all-surrounding, unfathomable sea? What is there more peacefully sublime, than the calm, gently-heaving, silent sea? What is there more terribly sublime than the angry, dashing, foaming sea? Power—resistless, overwhelming power—is its attribute and its expression, whether in the careless, conscious grandeur of its deep rest, or the wild tumult of its excited wrath.

It is awful when its crested waves rise up to make a compact with the black clouds, and the howling winds, and the thunder, and the thunderbolt, and they sweep on in the joy of their dreadful alliance to do the Almighty's bidding. And it is awful too, when it stretches its broad level out to meet in quiet union the bended sky, and show in the line of meeting, the vast rotundity of the world.

There is majesty in its wide expanse, separating and enclosing the great continents of the earth, occupying two-thirds of the whole surface of the globe, penetrating the land with its bays and secondary seas, and receiving the constantly pouring tribute of every river, of every shore. There is majesty in its fulness, never diminishing and never increasing. There is majesty in its integrity, for the whole of its vast substance is uniform; in its local unity, for there is but one ocean, and the inhabitants of any one maritime spot may visit the inhabitants of any other in the wide world.

Its depth is sublime; who can sound it? Its strength is sublime; what fabric of man can resist it? Its voice is sublime, whether in the prolonged sound of its ripple, or the stern music of its roar; whether it utters its hollow and melancholy tones within a labyrinth of wave-worn caves; or thunders at the base of some huge promontory; or beats against a toiling vessel's sides, lulling the voyager to rest with the strains of its wild monotony; or dies away with the calm and dying twilight, in gentle murmurs on some sheltered shore.

There is mystery in the sea. There is mystery in its depths. It is unfathomed, and perhaps unfathomable. Who can tell, who shall know, how near its pits run down to the central core of the world? Who can tell what wells, what fountains are there, to which the fountains of the earth are, in comparison, but drops? Who shall say whence the ocean derives those inexhaustible supplies of salt, which so impregnate its waters, that all the rivers of the earth pouring into it from the time of the creation, have not been able to freshen them?

What undescribed monsters, what unimaginable shapes, may be roving in the profoundest places of the sea, never seeking, and perhaps from their nature unable to seek, the upper waters, and expose themselves to the gaze of man? What glittering riches, what heaps of gold, what stores of gems, there must be scattered in lavish profusion on the ocean's

lowest bed! What spoils from all climates, what works of art from all lands have been ingulfed by the insatiable and reckless waves! Who shall go down to examine and reclaim this uncounted and idle wealth? Who bears the keys of the deep?

And oh! yet more afflicting to the heart, and mysterious to the mind, what companies of human beings are locked up in that wide, weltering, unsearchable grave of the sea! Where are the bodies of those lost ones, over whom the melancholy waves alone have been chanting requiem? What shrouds were wrapped round the limbs of beauty and of manhood, and of placid infancy, when they were laid on the dark floor of that secret tomb? Where are the bones, the relics of the brave and fearful, the good and the bad, the parent, the child, the wife, the husband, the brother, and sister, and lover, which have been tossed and scattered and buried by the washing, wasting, wandering sea?

The journeying winds may sigh, as year after year they pass over their beds. The solitary rain-cloud may weep in darkness over the mingled remains which lie strewed in that unwonted cemetery. But who shall tell the bereaved to what spot their affections may cling? And where shall human tears be shed throughout that solemn sepulchre? It is mystery all!

When shall it be resolved? Who shall find

it out? Who but He to whom the wildest waves listen reverently, and to whom all nature bows; He who shall one day speak and be heard in ocean's profoundest caves; to whom the deep, even the lowest deep, shall give up all its dead—when the sun shall sicken, and the earth and the isles shall languish, and the heavens be rolled together like a scroll, and there shall be "no more sea."

TIDES AND CURRENTS OF THE OCEAN.

Among the most wonderful phenomena of nature may be reckoned the tides of the sea. They were but little understood by the ancients, although Pliny, Ptolemy, and Macrobius, were of opinion that they were influenced by the sun and moon. The former expressly says, that the cause of the ebb and flow is in the sun, which attracts the waters of the ocean; and he adds, that the waters rise in proportion to the proximity of the moon to the earth.

Among the phenomena of the tides, one of the most singular is the bore, peculiar to several rivers: it is ascribed to the waters, which were before expansive, being suddenly pent up and confined within a narrow space. This bore, or impetuous rush of waters, accompanies the first flowing of the tide in the Perret, in Somersetshire, and in the Seine, in

France. It is also one of the peculiarities of the Severn, the most rapid river in England.

One of the greatest known tides is that of the Bristol Channel, which sometimes flows upwards of forty feet. At the mouth of the river Indus, the water rises thirty feet. The tides are also remarkably high on the coasts of Malay, in the Straits of Sunda, in the Red Sea, at the mouth of the river St. Lawrence, along the coasts of China and Japan, at Panama, and in the Gulf of Bengal. The most remarkable tides, however, are those at Batsha, in the kingdom of Tonquin, in 20° 50′ north latitude. In that port, the sea ebbs and flows once only in 24 hours, while in all other places there are two tides within that space.

What is still more extraordinary, twice in each month, when the moon is near the equinoctial, there is not any tide, the water being for some time quite stagnant. These, with other anomalies of the tides there, Sir Isaac Newton, with peculiar sagacity, ascertained to arise from the concurrence of two tides, one from the South Sea, and the other from the Indian Ocean. Of each of these two tides, there come successively two every day; two at one time greater, and two at another which are less. The time between the arrival of the two greater, was considered by him as high tide; that between the two less, as ebb. In short, with these simple facts in his possession, that great mathematician solved every appear-

ance, and so established his theory as to silence every opposer.

Besides the common and periodical tides, a variety of local currents are met with in different seas, on different parts of the ocean, and for the greater part at an inconsiderable distance from land. They have been usually ascribed to particular winds; but their origin is not easy to trace, as they have been occasionally found beneath the surface of the water, running in a contrary direction to the stratum above, and cannot, therefore, have been owing to winds or monsoons. These particular currents have been ascribed to the immense masses of polar ice, which produce a greater degree of cold in the under than in the upper stratum of waters; and it has been suspected that there is an under current of cold water flowing perpetually from the poles towards the equator, even where the water above flows towards the poles. The great inferiority of temperature, which is frequently found in deep and superficial soundings of the same space of water, is thus accounted for.

The most extraordinary current is that of the Gulf of Florida, usually called the "Gulf Stream," which sets along the coast of North America to the northward and eastward, and flows with an uninterrupted rapidity. It is ascribed to the trade winds, which, blowing from the eastern quarter into the great Mexican gulf, cause there an accumulation above the

common level of the sea. The water, therefore, constantly runs out by the channel where it finds the least resistance, that is, through the Gulf of Florida, with such force as to continue a distinct stream to a very great distance. A proof of its having thus originated is, that the water in the Gulf Stream has been found to have retained a great portion of the heat it had acquired in the torrid zone.

A very singular upper current often prevails to the westward of Scilly, and is highly dangerous to ships which approach the British Channel. Currents of this description are, however, more frequently met with about the Straits of Gibraltar, and near the West India islands, the coasts of which are so subject to counter tides, or extraordinary currents, that it is often dangerous for boats to land. They proceed to the westward, along the coasts of Yucatan and Mexico, and, running round into the gulf, return into the great ocean, by the Straits of Bahama, along the coasts of Florida, in order to pursue, in the north, the course ordained them by the great Author of nature.

In this course the waters run with an extraordinary rapidity, passing between the great and small American islands in the great deeps, by an almost even and imperceptible motion. Against the shores and coasts of these islands, which form an Archipelago, they are, however, very sensible and dangerous, interrupting the navigation, and rendering it scarcely

possible to stem them in proceeding to the eastward.

Besides these regular currents, there are others, called "counter tides," which are observable on the sea-coasts and shores. In places where these flow, the sea rises in an extraordinary manner, becoming very furious without any apparent cause, and without being moved by any wind. The waves rise and open very high, breaking on the shore with such violence, that it is impossible for vessels to land. These counter tides are chiefly ascribed to the pressure of the heavy black clouds which are occasionally seen to hang over an island, or over the sea.

The currents of the ocean, though exceedingly diversified both in velocity and direction, appear to result from the operation of two great causes, the rotation of the earth on its axis, and the inequality of the temperature. To these may be added the attractive influence of the sun and moon, which, by continually disturbing the equilibrium of the waters of the ocean, gives rise daily to a great variety of partial currents, which can only be thoroughly explained by an attentive examination of the local circumstances by which they are modified.

By the daily rotation of the earth on its axis, the equatorial parts of the globe are carried from west to east at the rate of upwards of a thousand miles per hour. The waters of the

ocean are not allowed to partake of the whole of this velocity, on account of their mobility, and the attraction of the two great luminaries, which, incessantly acting on their particles, prevents them from acquiring that stable condition of revolution, which they must otherwise have attained. Hence the solid parts of the globe being carried faster to the eastward than the waters of the ocean, the latter appear to have a motion in a contrary direction; and by this is produced that great equatorial current from east to west, which is known to prevail in the tropical regions.

The other cause, the inequality of temperature, gives rise to a current from the poles towards the equatorial parts, though its effects are neither so unequivocal, nor so extensively developed. The superior temperature of the atmosphere within the tropical zone, causes a much greater quantity of water to be evaporated from the surface of the ocean in that quarter than is subsequently restored by the rains and the discharge of rivers. By the atmospherical currents, the water thus evaporated is incessantly transported towards the poles.

During its progress, however, in these opposite directions, it is gradually exposed to a temperature more and more reduced, by which it is slowly converted to the state of water; and descending in the form of rain, supplies the various zones at a distance from the equa-

tor, with a greater quantity of moisture than they lose by evaporation. By this means the polar and temperate zones being furnished with a larger supply of water than is consistent with that form which the earth should possess, by the joint action of gravity and the centrifugal force of revolution, a current of the superfluous water must take place from the poles to the equator. This current, from the small quantity of water by which it is determined, is not very perceptible in the open ocean, but its actual existence is demonstrated by the floating masses of ice which are annually transported from each of the frigid zones towards the tropical regions.

The great equatorial current, to which we have already alluded, has even been ascribed entirely to the same cause. The waters flowing from the colder zones, to supply the quantity carried off by evaporation within the tropics, coming from regions where they were endowed with a smaller velocity of rotation, cannot, it must be admitted, suddenly acquire the same velocity as the more solid parts of the globe at the equator, and hence, like the great aerial fluid by which it is surrounded, they must appear to have a slow motion from east to west. That the equatorial current is partly owing to this, is very probable; but it seems too much to ascribe it entirely to a cause so apparently inadequate.

In endeavoring to trace the directions of the

subordinate currents, produced by the equatorial and polar streams, we shall begin at the western coast of America; both because the outline which it forms is the largest in one direction, which marks the land and water on the surface of the globe, and because, being nearly at right angles to the principal current, it seems, on that account, a better line of reference than any other. The Pacific Ocean, extending with little interruption to the westward of this line, the equatorial current from east to west appears to prevail almost universally over this vast expanse of water.

Having reached, in its motion round the globe, the eastern coast of Asia and New Holland, its direction is considerably modified by the various obstacles which suddenly oppose its progress to the Indian Ocean. One portion of the water forcing its way round the southern point of New Holland, occasions the strong currents which have been experienced by navigators in the straits between that island and Van Dieman's Land; while another portion of it, escaping through the various winding channels formed by the clustered islands between the northern extremity of New Holland and the coasts of Asia, produces a great variety of subordinate currents from the south, takes a northwesterly course, and proceeds towards the Gulf of Bengal. Having doubled Cape Comorin, it advances to the coasts of Africa, and sweeping along the shores of that

continent with augmented velocity, it again joins the general current in the Southern Atlantic, and resumes its westerly course.

In the Atlantic Ocean, the effects of the equatorial currents are distinctly recognised between the tropics: and within that range prevail, with very little exception, from the western coast of Africa, to the eastern shore of America. On reaching the coast of Brazil, it diverges, at Cape St. Augustine, into two streams, one of which proceeding in a southwest direction, runs parallel to the coast till it falls into the Pacific beyond Cape Horn; the other, following a northwesterly course, enters the Caribbean Sea, and afterwards penetrates into the Gulf of Mexico, between Yucatan and the island of Cuba. The former of these branches being resisted by the polar currents from the south, occasions several opposite currents between Sandwich Land and the island of Terra del Fuego.

The other branch, which enters the Gulf of Mexico, conspires with the large rivers that pour themselves into it, to raise the waters of the ocean considerably above their natural level along the shores which oppose their progress to the westward, in consequence of which they are forced to escape, with increased velocity, between Florida and Cuba. This powerful current, so well known to seamen under the name of the *Gulf Stream*, is afterwards compelled to flow towards the northeast by

the direction of the American coast. In its progress to a colder climate, it is distinguished from the waters of the Northern Atlantic, by its superior temperature and beautiful blue color. Its influence is even felt as far to the northward as Newfoundland, where it produces, by the copious exhalations from its surface, the dense fogs which generally hang over the surface of that inhospitable island.

After reaching Newfoundland, however, it becomes more exposed to the effects of the polar current from the north, by which its direction is determined more and more towards the east, and, aided by the westerly winds which prevail in that latitude, it shoots across the Atlantic to the coast of Norway and the British Isles. Here it is constrained, by the superior influence of the polar current, to assume a direction more southerly, and after advancing along the western shores of Europe and Africa, to join the great equatorial stream, probably a little beyond the Cape de Verde Islands.

Contiguous currents, flowing in opposite directions at the surface, are far from being of rare occurrence. Thus in the Kattegat, it is well known that one current enters the Baltic along the coasts of Jutland, while another glides out of it by the opposite shores of Sweden. In like manner, a current seems to proceed along the eastern coast of Britain, towards the south, while another, flowing in an opposite direction, advances along the coast of

Holland. The existence of opposite currents at different depths, though less frequent, is established by observation.

Even in some parts of the Caribbean Sea, where the equatorial current is strongly felt, it is affirmed that a boat may be retained in a fixed position by suspending from it a heavy body, at a depth sufficient to place it beyond the influence of the superficial stream. The stability of the boat, in such circumstances, must be ascribed to the operation of a contrary current below, which tends to carry the immersed body in an opposite direction to that in which the boat would be carried by the sole action of the stream at the surface. The eddies formed by ledges of rocks, running transversely to the direction of the stream, afford a sufficient explanation of the cause of these opposite currents at different depths.

THE DELUGE.

Deluge, in theology, signifies in general any great inundation; but more particularly that universal flood by which the whole inhabitants of this globe were destroyed, except Noah and his family. According to the most approved systems of chronology, this remarkable event happened in the year 1656 after the creation, or about two thousand three hundred and forty-eight before the Christian era.

Of so general a calamity, from which only a single family of all who lived then on the face of the earth was preserved, we might naturally expect to find some memorials in the traditionary records of Pagan history, as well as in the sacred volume, where its peculiar cause, and the circumstances which attended it, are so distinctly and fully related. Its magnitude and singularity could scarcely fail to make an indelible impression on the minds of the survivors, which would be communicated from them to their children, and would not be easily effaced from the traditions even of their latest posterity.

A deficiency in such traces of this awful event, though perhaps it might not serve entirely to invalidate our belief of its reality, would certainly tend considerably to weaken its claim to credibility; it being scarcely probable that the knowledge of it should be utterly lost to the rest of the world, and confined to the documents of the Jewish nation alone. What we might reasonably expect, has, accordingly, been actually and completely realized. The evidence which has been brought, from almost every quarter of the world, to bear upon the reality of this event, is of the most conclusive and irresistible kind; and every investigation, whether etymological or historical, which has been made concerning heathen rites and traditions, has constantly added to its force, no less than to its extent.

Besides, however, the allusions to the deluge in the mythology and religious ceremonies of the heathen, there is a variety of traditions concerning it still more direct and circumstantial, the coincidence of which with the narrative of Moses, it will require no common degree of skeptical hardihood to deny. These we shall now shortly adduce; beginning with those which are more distant and obscure, and then stating those which are more remarkably and circumstantially coincident with the Mosaic record.

We are informed by one of the circumnavigators of the world, who visited the remote island of Otaheite, that some of the inhabitants, being asked concerning their origin, answered, that their supreme God having, a long time ago, been angry, dragged the earth through the sea, when their island was broken off and preserved.

In the island of Cuba, the people are said to believe that "the world was once destroyed by water, by three persons," evidently alluding to the three sons of Noah. It is even related that they have a tradition among them, that an old man, knowing that the deluge was approaching, built a large ship, and went into it with a great number of animals; and that he sent out from the ship a crow, which did not immediately come back, staying to feed on the carcasses of dead animals, but afterwards returned with a green branch in its mouth.

The author who gives the above account likewise affirms, that it was reported by the inhabitants of Castella del Oro, in Terra Firma, that during a universal deluge, one man, with his children, were the only persons who escaped, by means of a canoe, and that from them the world was afterwards peopled.

According to the Peruvians, in consequence of a general inundation, occasioned by violent and continued rains, a universal destruction of the human species took place, a few persons only excepted, who escaped into caves on the tops of the mountains, into which they had previously conveyed a stock of provisions, and a number of live animals, lest when the waters abated, the whole race should have become extinct. Others of them affirm, that only six persons were saved, by means of a float or raft, and that from them all the inhabitants of the country are descended. They farther believe, that this event took place before there were any *incas* or kings among them, and when the country was extremely populous.

The Brazilians not only preserve the tradition of a deluge, but believe that the whole race of mankind perished in it, except one man and his sister; or, according to others, two brothers with their wives, who were preserved by climbing the highest trees on their loftiest mountains; and who afterwards became the heads of two different nations. The memory

of this event they are even said to celebrate in some of their religious anthems or songs.

According to Josephus, there were a multitude of ancient authors, who concurred in asserting that the world had once been destroyed by a flood. "This deluge," says he, "and the ark, are mentioned by all who have written Barbaric histories, one of whom is Berosus the Chaldean. Speaking of this event, he affirms that in Armenia, upon a mountain of the Corydeans, part of the ship is even yet remaining. It is a custom to scrape from off it some of the bitumen with which it was covered, and to carry it about as a talisman against diseases. Jerome the Egyptian, who wrote the ancient history of Phenicia, and Mnaseas, and many others, likewise mention these events. Nicolaus Damascenus relates, that there is a great mountain in Armenia, situated above Minyas, which is called *Baris*, to which many persons fled at the time of the deluge, and were preserved. One in particular was conveyed in an ark to the very summit of the mountain, and a considerable part of the vessel still remains. He perhaps may be the man concerning whom Moses the Jewish lawgiver wrote."

When we thus meet with some traditions of a deluge in almost every country, though the persons saved from it are said, in those various accounts, to have resided in different districts widely separated from each other, we are constrained to allow that such a general

concurrence of belief could never have originated merely from accident. While the mind is in this situation, scripture comes forward, and presenting a narrative, more simple, better connected, and bearing an infinitely greater resemblance to authentic history, than any of those mythological accounts which occur in the traditions of Paganism, immediately flashes a conviction upon the understanding, that this must be the true history of those remarkable facts, which other nations have handed down to us, only through the medium of allegory and fable.

By the evidence adduced in this article, indeed, the moral certainty of the Mosaic history of the flood appears to be established on a basis sufficiently firm to bid defiance to the cavils of skepticism. "Let the ingenuity of unbelief first account satisfactorily for this universal agreement of the Pagan world; and she may then, with a greater degree of plausibility, impeach the truth of the scriptural narrative of the deluge."

WHIRLPOOLS.

Near the coast of Norway, in about latitude 68, is a vast whirlpool, commonly called Maelstrom, or Moskoestrom, from the island of Moskoe, and by mariners the Navel of the sea. Its violence exceeds that of a cataract, being

heard at a great distance, without any intermission, except for a quarter of an hour, at the turn of high and low water, when its impetuosity seems at a stand; but this motion soon returns, and gradually increases with such a draught and vortex, as absorbs whatever comes within their sphere of action, keeping it for some hours under water, when the fragments shivered by the rocks appear again.

From this circumstance several authors imagine, that here is an abyss which penetrates the globe, issuing in some very remote parts. But the learned Bishop Pontoppidan observes, that there is no foundation for this conjecture; it having no other cause than the collision of the waves rising and falling at the flux and reflux, against a ridge of rocks and shelves, which confine the water, so that it precipitates like a cataract, and thus the higher the flood rises, the deeper must be the fall, the natural result of which is a whirlpool. Mr. Ramus is of the same opinion, and observes, that at the time of flood, the streams run up the country, between the islands of Lofoden and Moscoe, with a boisterous rapidity; but the roar of its impetuous ebb to the sea, is scarcely equalled by the loudest cataracts, the noise being heard at the distance of several leagues.

The whirlpool is then of such extent and depth, that if a ship comes within its attraction, it is inevitably absorbed, and dashed to pieces against the rocks at the bottom. But when

the stream is most boisterous, and its fury heightened by a storm, it is dangerous to come within six English miles of it; ships, boats, and yachts having been carried away by not guarding against it, before it was too late.

It frequently happens that even whales, coming too near the stream, are overpowered by its violence; and then it is impossible to describe their bellowings in their fruitless struggles to disengage themselves. A bear once attempting to swim to the island of Moskoe, in order to prey on the sheep feeding on the island, afforded a similar spectacle: for the stream caught him, and bore him down, while he roared so terribly as to be heard on shore. It is remarkable that large firs and pine trees, after being absorbed by the current, rise again with their trunks so broken and lacerated, that they seem as if covered with bristles.

The account we have of the whirlpools about the islands of Ferro, which belong to the crown of Denmark, given us by Mr. Jacobson Debes, provost of the churches in those islands, is also very extraordinary. The most dangerous is that which lies south of Suderoe, near a rock called the Monk, where several vessels have been swallowed up. The sea round this whirlpool is eighty or ninety fathoms deep, and the surface of the water is smooth and serene; but a little farther in, the ground lies at the depth of twenty-five or thirty fathoms, where the sea begins to rise and turn round. Within this

the ground lies from eight to ten or twelve fathoms deep, in four circles; and rises up in points or clifts; which are about eight fathoms under water, and about twelve distant from each other.

Between these circles are three channels from twenty-five to thirty fathoms deep, wherein the sea runs round; and within every circle is a hole, the depth of which, in the middle, is about sixty fathoms. The innermost current turns round but slowly, but the others with great swiftness. On the south side of this hole the rock called the Monk rises ten fathoms above the water, and north of this are six lesser rocks, on the top of which, our author observes, the compass turns round like the whirlpool. Considering the danger that vessels run by approaching this vortex, the reader may probably wonder how so particular a description of it could be taken; but our author informs us, that in very calm weather, during the reflux of the sea, the inhabitants venture to fish there, and to climb the rocks.

FISHES.

Though the ocean is allowed to be the grand receptacle of fishes, still a great variety are to be found both in rivers and streams; and many authors give it as a decided opinion, that the

whole species were naturally produced from the sea.

Though the wants of mankind, and the curiosity of individuals, have discovered great variety in this prolific race, yet their pursuits, migrations, antipathies, and pleasures, are concealed by that element in which they reside.

Most fishes offer the same external appearance, enlarging in the middle, and tapering towards the ends; and this form we endeavor to imitate in the construction of those vessels which sail upon the sea. Yet the progress of a machine moved forward by human contrivance, is not equal to that which Nature produces in a fish; for they can easily outstrip the swiftest sailer that ever ploughed the turbulent main.

The fins are the chief instruments in a fish's motion, which in some are more numerous than the rest: for one that is completely fitted for sailing is furnished with three single ones, and two complete pairs, and thus equipped, it migrates with the utmost rapidity, and in the course of a season will traverse three thousand leagues. Yet it does not always happen that those fish have the most rapid motion which are endowed with the greatest number of fins; for the shark is allowed to be one of the swiftest swimmers, but wants the ventral or belly fin. These fins not only serve the animal in progression, but in rising, sinking, turning, and even leaping out of the stream.

The flying-fish frequently rises out of the water, and pursues its course for a hundred yards, until, apparently exhausted by the exertion, it regains its vigor by sinking into the stream. The pectoral fins push the animal forward, and are placed behind the opening of the gills; the ventral fins grow under the belly; and the dorsal fin is situated along the back; this also assists the animal in motion, and enables it to keep an equilibrium in the stream: the anal fin grows near the tail, and serves to keep the fish upright, or in a vertical state. The tail is a more powerful assistant than the fins, as they are all in a certain degree dependent upon its aid; for whenever it wishes to turn, a blow from the tail sends it round; and when it strikes backward and forward, it gives addition to its speed.

As most animals that live upon land are furnished with a covering to defend them from the injurious change which weather might produce, so that numerous part of creation, which reside within the waters, are protected from their influence by a glutinous kind of matter that defends their bodies like a sheath; beneath this, many of the species have a strong covering of scales, under which is found an oily substance, which at once adds warmth and vigor to its life.

The fish, thus protected and fitted for motion, seems to be furnished with the means of happiness as well as quadrupeds or birds; but upon

a more minute examination of their faculties, we shall find the advantages of the latter greatly to be increased. The sense of touching, which beasts and birds are known to possess, (though not in a very great degree,) to the fish, covered with a coat of mail, must be unknown; and of the sense of smelling, which in beasts is allowed to be exquisite, the fish enjoys but a moderate share. It is true that all have one or more nostrils: but, as air is the medium through which odors necessarily pass, an animal residing constantly in water must receive every exhalation imperfect and faint.

Of tasting they can make but very little distinction, as the palate of most is bony and hard; and their hearing is allowed to be extremely doubtful; anatomists are of opinion that they cannot hear at all.

Seeing appears the sense which they possess in the greatest measure; yet those who have made observations on their eyes, assert that they all are extremely near-sighted, and cannot discover objects that are distantly removed.

From the observations of the naturalists, we easily discern that fishes are inferior both to birds and beasts; and even their brain, that mansion of sensation, is extremely small when compared to their size.

To preserve their own existence, and continue it to their posterity, fills up the whole

circle of their pursuits; a ceaseless desire of food seems to be the ruling impulse, and the only enjoyment they are capable of in life. Their digestive faculties are very extraordinary, for their stomachs will soften the shells of the most callous fish; and their whole lives are passed in a state of depredation, the larger of the species existing upon the small.

Nor is the pursuit of fishes, like that of terrestrial animals, confined to a single region of the globe; for shoals of one species follow the other, from the equator to the pole. The cod, from the Banks of Newfoundland, pursue the whiting, which flies before it, to the most southern shores of Spain; and the cachalot is said to follow shoals of herrings, and to swallow thousands at a single gulp. This may be one cause of their annual migration, though others likewise may be produced; they may change their residence for one more suited to their constitution, or more adapted for depositing their spawn.

It is remarkable that no fish are fond of very cold waters, and in summer are seen in numbers, lying in shallows near the shore, where the sun has the power of warming the water to the bottom; and, in the winter, at the lowest depths of the ocean, where the coldness of the atmosphere has not the power to reach.

The severity of the winter is fatal to many fresh-water fishes, as may frequently be observed after the breaking up of a frost; this is

often occasioned by the air being excluded from them by the thick impenetrability of the sheets of ice. Though all fish reside in the water, air is necessary to the preservation of their lives; yet nothing is more difficult to be accounted for, than the manner in which they obtain the supply. The use that is generally assigned to the air-bladder, is the enabling the fish to rise or sink at its will; but the ancients were of opinion that it was to come in aid of the lungs, and to remain as a kind of storehouse of air, to supply the animal if distressed; and to this opinion we are inclined to assent.

Hitherto we have seen the inhabitants of the ocean every way inferior to those which dwell upon the land; but, if they are capable of fewer enjoyments, they are generally endowed with a greater length of life; for, residing in an element subject to but little variation, they avoid many of the evils produced by the atmosphere's change, and their size continues to increase with their years.

There have been two methods devised for determining the age of fishes: the one is by the number of circles on the scales; and the other, by the transverse section of the back. When the scale of a fish is examined through a microscope, it will be found to consist of a number of circles one within another, resembling those which appear on the transverse section of a tree, and offering the same infor-

mation to the mind; for as the circles on the tree correspond with the years of its growth, so those upon the scales of the fish are proportioned to its life; and by this method Mr. Buffon assures us he discovered a carp to be a hundred years of age.

The age of those fish which are destitute of scales, may be discovered by separating the joints of the back, and then observing the number of rings which are exhibited upon the surface where they were joined. Though the discovery of these marks may be more ingenious than certain, there is no reason to doubt that the generality of the species are very long-lived. Those that have ponds are enabled to form an opinion of their ages, by making observations upon their different size. All sorts, a few of the larger ones excepted, multiply their kinds by hundreds and thousands at a time: some of their number bring forth their young alive; but the greater proportion are produced from eggs, which are either deposited at the bottom or the edges of the water, or float in millions on the surface of the stream.

Of these eggs, scarcely one in a hundred produces an animal, as the aquatic birds devour those that are found on the edges of the water, and those at the bottom become a prey to the fish. Still there are sufficient to supply the deep with inhabitants, and to provide for the wants of a considerable part of mankind; for Lewenhoeck tells us, that in one season a

gadus morhua will produce nine millions of eggs. The mackerel and flounder are likewise strikingly prolific; for the former spawns five hundred thousand, and the latter a million, in the year. Such an amazing increase, if permitted to come to maturity, would be much too abundant for the ocean to contain: yet two wise purposes are answered by this astonishing fecundity; for it is the means of preserving the species in the midst of numberless enemies, and serves the rest with that kind of sustenance that is most likely to contribute to the prolongation of their lives.

Fishes in general, the whale kind excepted, are entirely divested of all tenderness for their young, and, instead of nurturing them with that fondness conspicuous in the brute creation, frequently devour them with the same indifference as every other kind of food. Such is the general picture of these heedless hungry creatures; yet there are some endowed with finer feelings than the rest, and which seem to possess all those parental sensations which are so easily to be discovered both in quadrupeds and birds. These nurse their offspring with the fondest solicitude, and seem to experience all a mother's care.

Under this class comes the cetaceous tribe of fishes, or, as they may otherwise be termed, those of the whale kind. There are others, which, though not capable of nursing their young, yet bring them alive into the world, and

protect them both from danger and harm; these are termed cartilaginous, from having gristle instead of bones; but those which leave their spawn unprotected, and seem dead to those sensations which other parents feel, are distinguished by the name of spinous fishes, from the sharpness of their bones bearing a resemblance to a thorn.

Thus it may be observed, that there are three grand divisions; the cetaceous, the cartilaginous, and the spinous; all differing from each other in their appearance and conformation, and in their manner of educating their young.

MARINE REMAINS.

A TERM used by many authors to express the shells of sea-fishes, and parts of crustaceous and other sea animals, found in digging at great depths in the earth, or on the tops of high mountains. Their being lodged in these places, is an evident and unquestionable proof of the sea having been once there, since it must have covered those places where it has left its productions. It has been a favorite system with many, and particularly with the late Dr. Woodward, that all these marine bodies were brought to the places where they now lie, by the waters of the universal deluge; which, as we are informed by holy writ, cov-

ered the whole surface of the globe, and even the highest mountains.

But though this is a very ready expedient to account for many of the natural phenomena, yet there are evident proofs that it cannot have been the cause of all that is attributed to it, and there must necessarily have been some other cause of many of these remains having been placed where we now find them. Neither does the opinion of some particular authors, that partial inundations of different places have left these marine bodies behind them at the recess of the waters, seem sufficient to account for the multitudes of these remains, many of which we find thrown upon places inaccessible to such floods.

Signor Moro has attempted to account for these phenomena on a new plan of reasoning. He observes that it is the best basis of argument to begin from facts: and that if we can certainly find how some part of these animal remains come to be deposited at such great distances from their natural residence, we may very rationally conclude, that by the same means, be they what they will, all the rest were also brought thither. He adds, that the earth, once the bottom of the sea, or the level surface of a plain, may be, and frequently has been, in the memory of man, raised up into a mountain by subterranean fires, earthquakes, and volcanoes. He mentions the famous instance of the new island raised out of the bot-

tom of the sea near Santorini in the year 1707, which became of a circumference not less than six miles, and of the new mountain raised near Puzzoli in 1538.

These, and many other like facts, prove that the origin of mountains and islands may have been such, and that the matter they consist of may have been the same which was once the bottom of the sea; and that the marine bodies found in these mountains, were such as were living, or remaining of living fish at the time when the island or mountain was so raised above the surface of the water which before covered it.

This is no new opinion; but this author has set it in a new and much stronger light than ever it had appeared in before, by the instances and examples he has brought in proof of it. Some have been fond of believing that the bodies we call marine remains, were never indeed any parts of living animals, but that they are merely *lusi naturæ* formed in the places where they are found; but Fabius Columna proved this to be an error, showing that the shark's teeth, or glossopetræ of the island of Malta, when calcined by a strong fire, yielded ashes the same with those from animal bodies, and by no means of the same nature with those produced from calcined stones.

That changes of parts of the bottom of the sea into dry land have often been made, is proved not only from the late known instances,

but from the testimonies of Strabo, Pliny, and other writers of credit: and nothing is more obvious to reason, than that in the sudden rise of such parts of the bottom of the sea, all its contents, all the shells, and other hard parts of fishes lying there, would be carried up with it.

As some mountains and some islands must have certainly been produced in this manner, it is not impossible but that all of them may have been so; and there is no more than this required to account clearly and evidently for all the vast profusion of marine bodies on land as we find them, without having recourse to the improbable means of the universal deluge, which, for many plain reasons, cannot have been the cause; or to the effects of particular inundations, which must have been wholly incapable of lodging many of them there.

The lodgment of shells in the solid strata of mountains, is better accounted for by this system of Signor Moro than any other: and if it be asked why some mountains afford them in great plenty, and others do not at all, it will not be difficult to answer, by observing, that among the mountains of the more known parts of the world, some consist of mere solid rock, and others of various strata of earthy and other matter; that the first of these may be supposed primary or natural mountains, and the other, secondary or accidental ones: and that these marine remains are always wanting in the former, and usually are found in the lat-

ter, which is a fact greatly favorable to this system.

There are many difficulties attending the accounts of all authors of the formation of the earth, and the lodging of these bodies in it; nor is this last system without difficulty. The causes here assigned as to the origin of mountains and islands, doubtless have been so in regard to some, but scarcely to all; and the bodies here treated of are so numerous, in some particular places, that scarcely any account can solve the difficulty of their being collected together in so strange a manner.

SPONGE.

Sponge is a marine production, generally to be met with in the shops in pieces only. Its texture is cavernous and porous. Its great elasticity, and its property of imbibing, and as readily parting with, a large quantity of water, render it useful. Sponge is to be chosen as light as possible, perfectly clean, and free from stone, of as pale a color as may be, with small holes, and fine, and soft to the touch. It grows in the Archipelago, at considerable depths, on the rocks, about some of the islands there; and multitudes of people make a trade of diving for it. It is also common in the Mediterranean and many other seas, though in general browner or yellower, and not so

fine as that of the Archipelago. It adheres in large masses to rocks and stones, sometimes to large shells, and is either round, flat, or hollow, like a funnel.

There has been much dispute among naturalists concerning the real nature of the sponge; nor is it yet satisfactorily decided whether it belongs to the animal or vegetable kingdom. But it appears to be destitute of irritability as well as of any locomotive power; and some recent writers have maintained that it is during a part of its existence a vegetable, and during the rest an animal. The opinion that sponge is, like coral, the work of a polype, is erroneous.

GENERAL ACCOUNT OF SPRINGS

Spring, in Natural History, is a fountain or source of water, rising out of the ground. Various have been the opinions of philosophers concerning the origin of springs; but those which deserve notice are only the three following ones: 1. That the sea-water is conveyed through subterranean ducts, or canals, to the places where the springs flow out of the earth: but as it is impossible that the water should be thus conveyed to the tops of mountains, since it cannot rise higher than the surface, some have had recourse to subterraneous heats; by which being rarefied, it is supposed

to ascend in vapors through the bowels of the mountains. But as no sufficient proof is brought of the existence of these central heats, or of caverns in the mountains big enough to let the vapor ascend, supposing such heats, we shall not take up our reader's time with a formal refutation of this hypothesis.

2. As to those who advance the capillary hypothesis, or suppose the water to rise from the depth of the sea through the porous parts of the earth, as it rises in capillary tubes, or through sands or ashes, they seem not to consider one principal property of this kind of tube, or this sort of attraction: for though the water rise to the top of the tube or sand, yet will it rise no higher, because it is by the attraction of the parts above that the fluid rises, and where that is wanting it can rise no further. Therefore, though the water of the sea may be drawn into the substance of the earth by attraction, yet it can never be raised by this means into a cistern, or cavity, to become the source of springs. 3. The third hypothesis is that of the sagacious naturalist, Dr. Halley, who supposes the true sources of springs to be melted snow, rainwater, dew, and vapors condensed.

In order to prove that the vapors raised by the heat of the sun from the surface of the seas, lakes, and rivers are abundantly sufficient to supply the springs and rivers with fresh water, the doctor made the following experi-

ment: he took a vessel of water, made of the same degree of saltness with that of the sea, by means of the hydrometer; and having placed a thermometer in it, he brought it, by means of a pan of coals, to the same degree of heat with that of the air in the hottest summer. He then placed his vessel, with the thermometer in it, in one scale, and nicely counterpoised it with weights in the other: after two hours, he found that about the sixtieth part of an inch was gone off in vapor, and consequently in twelve hours, the length of a natural day, one tenth of an inch would have been evaporated.

From this experiment it follows, that every ten square inches of the surface of the water yield a cubic inch of water in vapor per day, every square mile 6,914 tons, and every square degree (or 69 English miles) 33 millions of tons. Now, if we suppose the Mediterranean to be 40 degrees long, and 4 broad at a medium, which is the least that can be supposed, its surface will be 160 square degrees, from whence there will evaporate 5280 millions of tons per day, in the summer time. The Mediterranean receives water from the nine great rivers following, viz. the Iberus, the Rhine, the Tiber, the Po, the Danube, the Neister, the Borysthenes, the Tanais, and the Nile, all the rest being small, and their waters inconsiderable.

Now let us suppose that each of these rivers

conveys ten times as much water to the sea as the Thames; which, as is observed, yields daily 76,032,000 cubic feet, which is equal to 203 millions of tons; and therefore all the nine rivers will produce 1827 millions of tons; which is little more than one-third of the quantity evaporated each day from the sea. The prodigious quantity of water remaining, the doctor allows to rains, which fall again into the seas, and for the uses of vegetation.

As to the manner in which these waters are collected, so as to form reservoirs for the different kinds of springs, it seems to be this: the tops of mountains, in general, abound with cavities, and subterraneous caverns formed by nature to serve as reservoirs; and their pointed summits, which seem to pierce the clouds, stop those vapors which fluctuate in the atmosphere, and being constipated thereby, they precipitate in water, and by their gravity easily penetrate through beds of sand and lighter earth, till they are stopped in their descent by more dense strata, as beds of clay, stone, &c., where they form a basin or cavern, and work a passage horizontally, and issue out at the side of the mountain. Many of these springs running down by the valleys, between the ridges of hills, and uniting their streams, form rivulets or brooks; and many of these, again, uniting on the plain, become a river.

Springs are either such as run continually, called perennial; or such as run only for a

time, and at certain seasons of the year, and therefore called temporary springs. Others again are called intermitting springs, because they flow and then stop, and flow and stop again: and, finally, reciprocating springs, whose waters rise and fall, or flow and ebb, by regular intervals.

GENERAL DESCRIPTION OF RIVERS.

When a stream is not large enough to bear boats or small vessels laden, it is called a rivulet or brook. The confluence of a number of the small streams produces what is called a river. The Wolga and Danube are each augmented, in their course, by not less than 200 tributary streams.

The current of rivers is at first occasioned by the descent of the ground; but this impulse once occasioned, sometimes drives them over ground that is almost level. Thus the Amazon descends only one tenth of an inch in a mile, for the last 400 miles of its course; the Paraguay, one thirty-third of an inch in the same distance. In one part of its course, the Seine descends only one foot in a mile; and the Ganges only one inch.

Many rivers are lost, or disappear in the earth, before they reach any extensive reservoir of water. In some instances, they appear to descend into caverns, and rise again at some

distance. The Rhone is lost in this manner, on the borders of Switzerland, and rises again at the distance of three hundred feet. The Guadiana of Spain is lost for several miles. The Tigris, meeting Mount Taurus, runs under it, and flows out at the other side of the mountain.

Most large rivers are subject to annual or semi-annual floods of greater or less extent. The floods of the Nile, of the Ganges, and of the Mississippi rise about thirty feet above the common level. The Ohio, and other branches of the Mississippi, often rise forty or fifty feet; and the Oronoco, from seventy to one hundred and twenty feet. The floods of the Oronoco, the Amazon, and the Ganges, cover the country for one hundred miles in breadth.

The floods of rivers are highly useful, by leaving behind a deposite of vegetable mud or slime, which renders the vales of rivers the most fertile spots on earth. Egypt is entirely dependent on the floods of the Nile for watering as well as fertilizing its lands.

The floods of rivers also are often very destructive, sweeping away houses and villages. It was estimated that the flood of the Ganges, in 1822, destroyed from 50,000 to 100,000 persons.

The waters of most rivers are impregnated with particles of minerals, metals, and other substances. Thus some rivers bring sands intermixed with gold, as in Japan, Peru, Mexico,

Africa, and Cuba. In Guinea is a river, where the negroes make it a business to separate the gold dust from the sand and sell it to the Europeans.

Rivers carry down in their course large quantities of sand and mud. By this means islands are frequently formed at the mouths of rivers. The extensive and rich Delta in Egypt has been entirely formed by the mud carried down by the waters of the Nile. In ancient times, the space occupied by it was a basin or gulf of the sea.

Rivers which flow through mountainous regions have steep and high banks, and the navigation is frequently obstructed; but those which have their course through alluvial regions have low banks, and are farthest navigable. Rivers are rapid in proportion to their straightness, all other things being equal.

Some rivers are much augmented by frequent rains or melted snow. In the country of Peru and Chili, there are small rivers that only flow in the day; because they are only fed by the snow upon the mountains of the Andes, which is then melted by the heat of the sun. There are also several rivers upon both sides of the extreme parts of Africa and in India, which, for the same reason, are greater by day than by night. The rivers also in these places are almost dried up in summer, but swell and overflow their banks in winter, or in the wet season. Thus the Wolga, in

May and June, is filled with water, and overflows its shelves and islands, though, at other times of the year, it is so shallow as scarcely to afford a passage for loaded ships.

Rivers usually have their sources in mountains or elevated grounds; in the descent from which it is mostly that they acquire the velocity or acceleration which maintains their future current. In proportion as they advance, this velocity diminishes, on account of the continual friction of the water against the bottom and sides of the channel; as well as from the various obstacles they meet with in their progress, and from their arriving at length in plains, where the descent is less, and consequently their inclination to the horizon greater.

When the acquired velocity is quite spent, through the many obstacles, so that the current becomes horizontal, there will then nothing remain to propagate the motion and continue the stream, but the depth or the perpendicular pressure of the water, which is always proportional to the depth. And this resource increases as the occasion for it increases; for in proportion as the water loses the velocity acquired by the descent, it rises and increases in its depth. It appears from the laws of motion, pertaining to bodies moved on inclined planes, that when water flows freely upon an inclined bed, it acquires a velocity, which is always as the square root of the quantity of descent of the bed. But in a ho-

rizontal bed opened by sluices or otherwise, at one or both ends, the water flows out by its gravity alone.

The greatest velocity of a river is about the middle of its depth and breadth, or that point which is the farthest possible from the surface of the water, and from the bottom and sides of the bed or channel. Whereas, on the contrary, the least velocity of the water is at the bottom and sides of the bed, because there the resistance arising from friction is the greatest, which is communicated to the other parts of the section of the river inversely as the distances from the bottom and sides.

The union of two rivers into one makes the whole flow the swifter, because, instead of the friction of four shores, they have only two to overcome, and one bottom instead of two; also, the stream, being farther distant from the banks, goes on with the less interruption; besides that a greater quantity of water, moving with a greater velocity, digs deeper in the bed, and of course retrenches its former width. Hence also it is, that rivers, by being united, take up less space on the surface of the earth, and are more advantageous to low grounds, which drain their superfluous moisture into them, and have also less occasion for dikes to prevent their overflowing.

THE NILE.

——— with annual pomp,
Rich king of floods! o'erflows the swelling Nile.
THOMSON.

THIS celebrated river is likewise called Abanchi, signifying in the Abyssinian tongue, "the father of rivers," and is named by the Africans Neel Shem, the Egyptian river. It divides Egypt into two parts; and its extent, from its source, is supposed to exceed two thousand miles. It arises from amidst the Mountains of the Moon, in Upper Ethiopia, and flows into the Mediterranean Sea by seven channels, two only of which are at present navigable. The ancients were entirely ignorant of the source of this river, although many endeavors were made by them to explore it; but it is now well known to lie in about the twelfth degree of north latitude. It enters the lake of Dambia, in Abyssinia, crossing one of its extremities with such extreme rapidity, that its waters may be distinguished through a progress of six leagues within this lake.

Here its magnificence commences: after a farther progress of about fifteen miles, it rushes precipitately from the summit of a high rock, forming one of the most beautiful waterfalls known. It now again collects its scattered streams among the rocks, which seem to be disjointed in that part merely to afford it a passage. They are so close to each other, that

a bridge of beams was once laid over them to afford a passage to an army; and Sultan Segued built over them a bridge of one arch, to construct which he procured masons from India.

The greater part of Lower Egypt is contained in a triangular island, formed by the Mediterranean Sea and the two great branches of the Nile—which dividing itself five or six miles from Old Cairo, flows on the one side to the northeast, falling into the sea at Damietta; while the other branch runs to the northwest, and enters the sea at Rosetta. What is called the Delta, resembling the Greek letter of that name, and constituting a triangle, is thus formed.

The water of the Nile is thick and muddy, more particularly when the river is swollen by the heavy rains, which constantly fall within the tropics in the beginning of the summer season, and which are doubtless the principal cause of its overflowing the low lands of Egypt. A similar phenomenon in the Ganges will be noticed in the next article; and it is the same with all the rivers which have either their rise or course within the tropics; they annually break their bounds, and cover the lands for many miles on each side, before they reach the sea. They likewise leave prolific mud, which, like that of the Nile, fertilizes the land; besides which, the north winds prevailing about the latter end of May, drive in

the waters from the sea, and keep back those of the river, in such a manner as considerably to assist the swell.

The Egyptians, and the Copts more especially, are persuaded that the Nile always begins to rise on the same day of the year; as, indeed, it generally commences on the 18th or 19th of June. Its rise was observed for three successive years by Dr. Pococke, who found it to ascend during the first five days from five to ten inches; and it thus continued rising till it had attained the height of nine feet, when the Canal of Cairo was cut. It then rose from three to five inches only in the day; for having spread over the land, and entered the canal, although more water might have descended than before, its rise was less considerable. The other canals were now laid open at stated times, and those which water the lower grounds, the last. These canals are carried along the highest parts of the country, to the end that the water may be conveyed to the valleys.

The Nile has one peculiar characteristic. Other rivers being supplied by rivulets, the ground is lowest near their banks; but as not any water flows into the Nile in its passage throughout Egypt, and as it is necessary that this river should overflow the land, the country is generally lower at a distance from, than near to it; and, in most parts, the land has a gradual descent from the river to the foot of

the hills, which terminate the sandy plains most benefited by the irrigation.

Among other remarkable appearances, the celebrated Bruce notices a very singular one attendant on the inundation of the Nile. In Abyssinia, the early part of the morning is constantly clear in that season, with a fine sunshine. About nine, a small cloud, not above four feet in apparent breadth, appears in the east, whirling violently round as if on an axis; but having approached nearly to the zenith, it first abates its motion, and then loses its form, extending itself greatly, and seeming to call up vapors from all the opposite quarters.

The clouds thus formed, having attained nearly the same height, rush against each other with great violence, and remind the spectator of Elisha foretelling rain on Mount Carmel. The air being impelled before the heaviest mass, or swiftest mover, makes an impression of its form on the collection of clouds opposite; and the moment it has taken possession of the space made to receive it, the most violent thunder possible to be conceived follows instantly, attended by rain. After some hours, the sky again clears, with a wind at the north; and it is always disagreeably cold when the thermometer is below sixty-three degrees.

Dr. Clarke, in his travels, draws the following elegant picture of this most interesting river:—

"Here we were unexpectedly greeted with an astonishing view of the Nile, the Delta, and the numerous groves in the neighborhood of Rosetta. The scene is beyond description. The sudden contrast it offers, opposed to the desert we had traversed, the display of riches and abundance poured forth by the fertility of this African paradise, with all the local circumstances of reflection, excited by an extensive prospect of the Nile, and of the plains of Egypt, render it one of the most interesting sights in the world. The beautiful boats peculiar to the Nile, with their large wide-spreading sails, were passing up and down the river. Unable to quit the spot, we dismissed our guides, and remained some time contemplating the delightful picture. Afterwards, descending on foot, close by the superb mosque of Abu-mandur, we continued our walk along the banks of the Nile, through gardens richer than imagination can portray, beneath the shade of enormous overhanging branches of sycamore and fig trees, amidst bowers of roses, and through groves of date, citron, lime, and banana trees, to Rosetta."

THE GANGES.

Both in magnitude and extent, the Ganges is a most noble and majestic river. It rises in the kingdom of Thibet; entering Hindostan

about the thirtieth degree of latitude, and runs first southeastward by the cities of Bekaner, Minapor, Halabes, Benares, and Patna, to Rajah Mahl, where it divides into two branches. The eastern having passed by Dakka, the capital of Bengal, enters the gulf of that name about Chatigan. The western, descending by Kossum-bazar and Hughly, falls into the gulf below Chandernagor towards Pipeli. Many of the Jews and ancient Christians believed this river to be the Pison, one of the four mentioned in Scripture as the boundaries of the terrestrial paradise.

The length of the Ganges exceeds fourteen hundred miles. The Burrampooter, its proudest auxiliary, is nearly of the same length; and the opinion generally entertained, is, that the sources of these mighty rivers are not far distant from each other. Each of them runs, however, nearly a thousand miles, before they unite and constitute one common stream, falling into the Bay of Bengal by several mouths. Ganga is, in the Hindostan language, a general term for a river; but it is particularly applied to this one on account of its unrivalled magnificence.

The Hindoos have a superstitious veneration for all the great rivers which fertilize their country; but the waters of the Ganges are to them peculiarly sacred. In its impetuous course it opens a passage through Mount Himmeleh, and again appears amidst impending

rocks, which resembling on an immense scale the head of a cow, an animal equally esteemed by the Hindoos as was the apis or sacred ox among the Egyptians, their religious awe for the Ganges is on that account enhanced.

Not any river in the world imparts greater benefits to the countries through which it passes; for, by annually overflowing its banks like the Nile, it waters and manures the country to an extent of a hundred miles in breadth. The Hindoos, having deified this river, make it an act of their religion to perform a pilgrimage to it, supposing its waters to purify from defilement such as bathe in them. On its slimy shore they bury their dead, and also remove those who are at the point of death to its banks, or to those of some one of the creeks which run into it.

On certain festivals, a concourse of upwards of a hundred thousand persons assemble to bathe in the Ganges, on the banks of which are a great number of superb and immensely rich pagodas. But what principally distinguishes this river, besides its greatness and rapidity, is the gold it brings down in its sands, and throws on its banks; and the precious stones and pearls it produces, not only in itself, but in the Gulf of Bengal, into which it discharges its waters, and which abounds with them.

THE RIVER JORDAN.

In the middle of the night of the 14th of April, (says Abbé Maritis,) we were desired to be ready to quit the plain of Jericho, that we might march forward to the river Jordan; and soon after we set out.

This march had something in it very grand, on account of the great number of lights carried by the horsemen who preceded and surrounded us. These lights are made by means of iron boxes, suspended from the points of lances, and in which is burnt the wood of the pine, or any other resinous tree. All persons of distinction travel in this manner during the night.

The plains here are intersected by ditches, rivulets, and torrents, which at this season of the year were dry. We found nothing worthy of observation in them but the ruins of an ancient church, dedicated to St. John the Baptist. Our pious orientals bowed themselves as they passed them; and out of respect for the memory of the saint, caused their horses to do the same.

An immense and beautiful meadow opened before us, in which we intended to erect our tents. It is washed by the waters of the river Jordan, which refresh it and add greatly to its fertility. When we halted, two altars were erected in haste, upon which the fathers of the Holy Land celebrated mass. No time indeed

could be more favorable for prayer. The first rays of the sun began to gild the summits of the neighboring mountains: the clouds which obscured the heavens had retired, and displayed to view a most enchanting horizon: but in separating they shed upon the earth a gentle dew, which seemed to insinuate itself into my veins, to refresh my blood, and even my thoughts, if I may be allowed the expression, and to dispose my soul for joy and sensibility, and to inspire it with gratitude towards the Author of Nature.

But why should superstition, even in this rustic temple, be mixed with those prayers which were addressed to the Almighty? Here the pilgrim discharges his vow: his only intention, in undertaking this short journey, was to come and contemplate the sacred and miraculous waters, to drink of them, and to bathe in them; because, it is said, they purify both the soul and the body. The Greeks even imagine that people are not properly baptized until they have plunged three times into the river Jordan. Men, women, and children, therefore, may be seen throwing themselves into the water together, with an eagerness almost bordering on madness, without thinking that they offend both against modesty and decency.

The custom of bathing in this river is as ancient as the age of Elisha. "Go," said that prophet to Naaman, who was afflicted with

the leprosy, "and wash in Jordan seven times, and thy flesh shall come again unto thee, and thou shalt be clean." Naaman obeyed; and as a reward for his faith, his blood was purified, and his flesh became as sound as that of an infant.

The Jordan, in the Arabic language, is called *Sceriah.* It has its source at the bottom of the Anti-Libanus, in the country called by the Syrians, Vadettin; and is formed from the waters of two fountains, which are a mile distant from each other. One of them lies to the east, and is called *Jor;* the other, which is exposed to the south, is named *Dan.* We see, therefore, that by uniting their waters, they have united their names also, to form that of the river to which they give birth.

The confluence of the two streams is found near the ancient city of Cæsarea Philippi, which is at present only a large village, inhabited by the Druses, and called Behne.

The river begins its course between the east and the south; and, after running seven miles, falls into the lake Samochon or Meron, at present called Hulet Panias.

This lake is six miles in length, from north to south; and may be about four in breadth, from east to west. Abundant in water during the winter, it is almost dry in summer, and leaves its muddy blackish bottom exposed to view. Its banks are covered with reeds and bulrushes; and in the neighborhood arise a

number of fruit-trees, forming a kind of forest, to which travellers would retire for the sake of its cool shade, had not ferocious animals, such as the tiger, made it their usual haunt. The Jordan issues from this lake, augmented by part of its waters; flows through the plain; and, two miles thence, passes under a stone bridge, called by the Arabs, *Gisrjaacub*, that is to say, Jacob's bridge. This bridge is 60 cubits in length, and only ten in breadth. It consists of three arches, which appear to be exceedingly well constructed. The inhabitants have a great veneration for it, because, they say, the patriarch Jacob crossed it when he fled from the vengeance of his brother Esau.

We read, in William of Tyre, that this bridge served also as a bulwark to Baldwin IV. against the Saracen armies, and that this prince caused a citadel to be constructed upon a neighboring hill.

The river follows the same direction between Traconitis and Galilee, as far as the Lake of Tiberias, near the ancient Chorazin and Capernaum, with which it mixes its water.

When it issues from this lake, which it crosses for the space of eighteen miles, it takes the name of Jordan Major. It advances 10 miles towards the south; divides Perea from Samaria, the plains of the Moabites from Judea; and receives in its passage several rivers, rivulets, and streams; such as the Jacob, which has its source in the mountains of Ara-

bia; the Dibon, so called from a city of the Amorites, near which it arises; the Jazer, that issues from a rock where there was a city of the same name, possessed by the tribe of Gad; and the Cherith, a considerable brook, celebrated, according to the Scriptures, for the retreat of the prophet Elijah, who was here fed by the ravens. After being augmented by all these streams, which water the beautiful plains of Aylona, in a course of 65 miles, from the Lake of Tiberias, the Jordan throws itself into the Dead Sea.

This river may be, in general, about 35 cubits in breadth; but when the snow is thawed, or during the rainy season, its waters increase, overflow its banks, extend to the distance of more than four miles, and, on account of the inequality of the ground, are divided sometimes into two or three channels. It is about six cubits in depth.

It is so rapid, at all times, that the strongest swimmer cannot cross it; and I am of opinion (says the writer) that it would even be dangerous to cross it in a boat, unless one had the mantle of Elijah. Its waters are always muddy; but when taken from the river and put into any kind of vessel, they immediately purify, leaving at the bottom a black sediment mixed with bituminous particles. These waters, however, are sweet, will not soon corrupt, and abound with fish.

Both sides of the Jordan are bordered by a

forest of tufted trees, which grow so closely in some parts that they are impenetrable to the rays of the sun. This forest, like that in the neighborhood of Lake Samochon, is the retreat of tigers, which sometimes carry desolation to the surrounding country.

These forests are peopled also with birds of every kind, and particularly with nightingales, whose melodious strains delight the ear, and make the traveller almost forget the danger of approaching the river.

The Jordan served, in some measure, to add to the triumph of Titus. A triumphal arch may still be seen at Rome, upon which this river is represented, under the figure of an old man leaning upon an urn, and submitting his head to the chains of the conqueror.

We find, in the annals of Florence, that Francis I., of Medicis, grand duke of Tuscany, was baptized with the water of the Jordan, which Albert Bolognetti, the nuncio, caused some merchants to bring on purpose, as if it had been endued with any superior virtue; but such was the superstition of the times, that people believed that the stains of original sin were better washed away by that water than by any other. It is astonishing, therefore, that the nobility, who at that period imagined they were much superior to the rest of mankind, did not think of causing themselves to be baptized with this privileged water, which would have imprinted on them at their birth

so remarkable a distinction. After the caravan had discharged their religious duties, we quitted the Jordan in order to return to Jericho.

CORAL FORMATIONS.

Coral belongs to the class of those surprising productions of nature, which are named *zoophites*, or plant-animals, on account of their filling up the intermediate space between the animal and vegetable kingdoms. Zoophites make a most interesting department for study in natural history. The production of coral reefs and islands presents one of those geological changes, by which the earth's surface has been modified, and has received a new accession from the sea.

The common foundation of the clusters of islands discovered by modern navigators in the Pacific Ocean, as well as of those belonging to New South Wales, is evidently of coral structure, immense reefs of which shoot out in all directions. There is every reason to believe that the islands which are occasionally raised by the tremendous agency of subterraneous volcanoes, do not bear any proportion to those which are perpetually forming, by the silent but persevering efforts of the sea worms by which coral is produced.

Banks of coral are found at all depths, and

at all distances from the shore, entirely unconnected with the land, and detached from each other. By a quick progression, they grow up towards the surface; while the winds, heaping up the coral from deeper water, chiefly accelerate the formation of these banks into shoals and islands. They become gradually shallower; and when once the sea meets with resistance, the coral is quickly thrown up by the force of the waves breaking against the bank. These coral banks have been seen in all their stages—some in deep water—others with a few rocks appearing above the surface, just formed into islands without the least appearance of vegetation; and, lastly, others covered with soil and weeds.

The loose corals, rolled inward by the billows in large pieces, ground, and the reflux being unable to carry them away, become a bar to the coagulated sand with which they are always intermixed. This sand being easiest raised, is lodged at top; and when its accumulated mass is elevated by violent storms, and no longer within the reach of common waves, it becomes a resting-place to birds whom the search of prey draws thither. Their dung, feathers, &c. augment the soil, and prepare it for the reception of accidental roots, branches, and seeds, cast up by the waves, or brought thither by birds. Thus islands are formed: the leaves and rotten branches, intermixing with the sand, produce in time a

light black mould, in which trees and shrubs vegetate and thrive. Cocoa-nuts, which continue long in the sea without losing their vegetative powers, having been thrown on such islands, produce trees which are particularly adapted to all soils, whether sandy, rich, or rocky.

The violence of the waves within the tropics must generally be directed to two points, according to the monsoons. Hence the islands formed from coral banks must be long and narrow, and lie nearly in a meridional direction. Even supposing the banks to be round, as they seldom are when large, the sea meeting most resistance in the middle, must heave up the matter in greater quantities there, than towards the extremities; and, by the same rule, the ends will generally be open, or at least lowest. They will also commonly have soundings there, as the remains of the banks, not accumulated, will be under water. Where the coral banks are not exposed to the common monsoon, they will alter their direction, and become either round, or extended in the parallel, or of irregular forms, according to accidental circumstances.

Captain Flinders, in his voyage to Terra Australis, gives a lively and interesting description of a coral reef on the southern coast of New South Wales. On this reef he landed, and the water being very clear round the edges, a new creation, as it were, but imitative of the

old, was presented to the view. Wheat sheaves, mushrooms, stags' horns, cabbage leaves, and a variety of other forms, were glowing under water with vivid tints of every shade between green, purple, brown, and white; equalling in beauty, and excelling in grandeur the most favorite *parterre* of the curious florist. These were different species of coral and fungus, growing, as it were, out of the solid rock, and each had its peculiar form and shade of coloring; but, while contemplating the richness of the scene, the destruction with which it was pregnant could not be forgotten.

Different corals in a dead state, concreted into a solid mass of a dull white color, composed the stone of the reef. The negro heads were lumps which stood higher than the rest; and being generally dry, were blackened by the weather; but even in these the forms of the different corals, and some shells were distinguishable. The edges of the reef, but particularly on the outside where the sea broke, were the lightest parts; within these were pools and holes containing live corals, sponges, sea-eggs, and cucumbers; and many enormous cockles were scattered upon different parts of the reef. At low-water, these cockles seem most commonly to lie half open; but frequently close with much noise—and the water within the shells then spouts up in a stream, three or four feet high: it is from this noise and the spouting of the water that they are discovered,

for, in other respects, they are scarcely to be distinguished from the coral rock.

His description of a coral island which he afterwards visited on the same coast, is truly philosophical, and throws great light on these surprising productions of nature.

"This little island, or rather the surrounding reef, which is three or four miles long, affords shelter from the southeast winds. It is scarcely more than a mile in circumference, but appears to be increasing both in elevation and extent. At no very distant period of time, it was one of those banks produced by the washing up of sand and broken coral, of which most reefs afford instances, and those of Torres' Strait a great many. These banks are in different stages of progress; some, like this, are become islands, but not yet habitable; some are above high-water mark, but destitute of vegetation; while others are overflowed with every returning tide.

"It seems to me, that, when the animalcules which form the corals at the bottom of the ocean, cease to live, their structures adhere to each other by virtue either of the glutinous remains within, or of some property in salt water; and the interstices being gradually filled up with sand and broken pieces of coral washed by the sea, which also adhere, a mass of rock is at length formed. Future races of these animalcules erect their habitations upon the rising bank, and die in their turn, to in-

crease, but principally to elevate, this monument of their wonderful labors.

"The care taken to work perpendicularly in the early stages, would mark a surprising instinct in these diminutive creatures. Their wall of coral, for most part in situations where the winds are constant, being arrived at the surface, affords a shelter, to leeward of which their infant colonies may be safely sent forth, and to this their instinctive foresight it seems to be owing, that the windward side of a reef exposed to the open sea, is generally, if not always, the highest part, and rises almost perpendicular, sometimes from the depth of two hundred, and perhaps many more fathoms.

"To be constantly covered with water, seems necessary to the existence of the animalcules, for they do not work, except in holes upon the reef, beyond low-water mark; but the coral sand and other broken remnants thrown up by the sea adhere to the rock, and form a solid mass with it, as high as the common tides reach. That elevation surpassed, the future remnants, being rarely covered, lose their adhesive property; and remaining in a loose state, form what is usually called a key upon the tops of the reef. The new bank is not long in being visited by sea birds; salt plants take root upon it, and a soil begins to be formed; a cocoa-nut is thrown on shore; land birds visit it and deposite the seeds of shrubs and trees; every high tide, and still more every

gale, adds something to the bank; the form of an island is gradually assumed—and last of all comes man to take possession.

"This island is well advanced in the above progressive state; having been many years, probably some ages, above the reach of the highest spring tides, or the wash of the surf in the heaviest gales. I distinguished, however, in the rock which forms its basis, the sand, coral, and shells formerly thrown up, in a more or less perfect state of cohesion; small pieces of wood, pumice-stone, and other extraneous bodies, which chance had mixed with the calcareous substances when the cohesion began, were enclosed in the rock; and, in some cases, were still separable from it without much force. The upper part of the island is a mixture of the same substances in a loose state, with a little vegetable soil; and is covered with the *casuarina* and a variety of other trees and shrubs, which give food to paroquets, pigeons, and some other birds; to whose ancestors it is probable the island was originally indebted for this vegetation."

THE ART OF DIVING.

The act of descending to a considerable depth beneath the surface of water, and continuing in that situation a sufficient time, to collect valuable articles from the bottom of

rivers, or the sea; such as pearls, sponges, coral, and other submarine productions; or to recover goods lost by shipwreck.

Man does not appear to have been intended by nature for diving, or at least for continuing any time under water; regular respiration being so necessary to his life, that, by the greatest inspiration, he cannot carry down a larger quantity of air than will supply him for two minutes. This we learn from Dr. Halley is possible, as he observed in a Florida Indian diver at Bermudas; but it is certainly an extreme case, for ordinary persons generally begin to feel a danger of suffocation in the space of half a minute after submersion in water. The doctor relates, that those who dive in the Archipelago for sponges, have a practice of taking in their mouths a piece of sponge dipped in oil, with a view, he supposes, of inhaling the air which the sponge contains; and from this they are enabled to dive a longer time than others who employ no artifice. It is not easy to conceive how this can assist the diver's breathing; for the introduction of any foreign substance into the mouth must necessarily diminish the quantity of air he can take down. But we have been lately informed, that the real object of taking oil in their mouths is to calm those small waves on the surface of the sea, which prevent the light being so steadily transmitted to the bottom, as is necessary to enable the divers to find the small objects they

search for, without delay. By ejecting a little oil from their mouths, it rises to the surface, and spreading upon it, calms the waves in a most remarkable manner, and gives a brilliant light at the bottom. This singular property of oil has been long known, and is practised in many other ways to allay the agitation of the sea, by fishermen and mariners.

A diver has to go through a very great exertion in holding his breath when deep under water; for it should be observed, that an equally great difficulty with the want of air arises, in diving at considerable depths, from the pressure of the water upon the surface of the body, tending to compress every cavity within it. It requires a very great muscular strength in the diver to resist this action; no breastplate or other contrivance can defend him, unless it is made to exclude perfectly the water from his breast, and of sufficient strength to bear the pressure; in which case it would become too heavy and cumbersome to permit his speedy descent and return.

To dive at all requires long practice, and habitual exposure to the weight of the water, after the habit of retaining the breath is sufficiently acquired; and it is observed, that when the most expert divers continue to dive repeatedly for any length of time in deep water, their eyes become bloodshot, and a spitting of blood is induced from the great exertion. People who are accustomed to the water from

their infancy, will at length be enabled not only to remain much longer under water than could be supposed, but acquire a kind of amphibious nature, so that they seem to have the use of all their faculties, as well when their bodies are immersed in water, as when they are on dry land.

Many savage nations are remarkable for this, and, according to the accounts of late voyagers, the inhabitants of the South Sea Islands are such expert divers, that when a nail or any piece of iron was thrown overboard, they would instantly jump into the sea after it, and never fail to recover it, notwithstanding the quick descent of the metal. Even among civilized nations many persons have been found capable of continuing an incredible length of time under water.

The most remarkable instance of this kind is the famous Sicilian diver *Nicolo Pesce*, who, according to the marvellous account given by Kircher, had from his infancy been so used to the sea, that at last it became his most natural element. It is said he was frequently known to spend five days in the midst of the waves, without any other provisions than the fish which he caught there, and ate raw. He often swam over from Sicily into Calabria, which is a tempestuous and dangerous passage, carrying letters from the king, and as frequently swam among the gulfs of the Lipari Islands, without any apprehension of danger. "In aid," says

Kircher, "of these powers of enduring the deep, nature seemed to have assisted him, in a very extraordinary manner; for the spaces between his fingers and toes were webbed as in a goose, and his chest became so very capacious, that he could take in at one inspiration, as much breath as would serve him a *whole day*."

At length, however, we are told, this extraordinary person met his fate, in exploring the depths of the whirlpool of Charybdis, at the instance of the king, who, after he had once succeeded in fetching up a golden cup that had been thrown in, ordered him to repeat the experiment. The authenticity of this account depends wholly upon the authority of Father Kircher, who assures us he had it from the archives of Sicily, and that the Sicilian king above mentioned was king Frederic. But, notwithstanding this assertion, the whole is so marvellous, as to prevent us from giving any particulars of the wonders which his hero saw at the bottom of the celebrated Charybdis.

THE DIVING-BELL.

The Diving-bell is a machine so contrived, that the diver is safely conveyed to any reasonable depth; and may stay more or less time under the water, as the bell is greater or less. It is most conveniently made in the form of a truncated cone, the smallest base being

closed, and the larger open. It is to be poised with lead, and so suspended, that it may sink full of air, with its open basis downward, and as near as may be in a situation parallel to the horizon, so as to close with the surface of the water all at once.

Under this covercle the diver sitting sinks down with the included air to the depth desired; and if the cavity of the vessel can contain a ton of water, a single man may remain a full hour without much inconvenience, and at five or six fathoms deep. But the lower he goes, still the more the enclosed air contracts itself, according to the weight of the water that compressed it; so that at thirty-three feet deep the bell becomes half full of water, the pressure of the incumbent water being then equal to that of the atmosphere; and at all other depths, the space occupied by the compressed air in the upper part of its capacity, is to the space filled with water, as thirty-three feet to the depth of the surface of the water in the bell below the common surface of it. And this condensed air, being taken in with the breath, soon insinuates itself into all the cavities of the body; and has no ill effect, provided the bell be permitted to descend so slowly as to allow time for that purpose.

When the English, in 1588, dispersed the Spanish fleet, called the Invincible Armada, part of the ships went to the bottom, near the isle of Mull, on the western coast of Scotland;

and some of these, according to the account of the Spanish prisoners, contained great riches. This information excited, from time to time, the avarice of speculators, and gave rise to several attempts to procure part of the lost treasure. In the year 1665, a person was so fortunate as to bring up some cannon, which, however, were not sufficient to defray the expenses.

In the year 1680, William Phipps, a native of America, formed a project for searching and unloading a rich Spanish ship, sunk on the coast of Hispaniola; and represented his plan in such a plausible manner, that the king, Charles II., gave him a ship, and furnished him with every thing necessary for the undertaking. He set sail in the year 1683; but being unsuccessful, returned again in great poverty, though in a firm conviction of the possibility of this scheme. By a subscription promoted chiefly by the duke of Albemarle, the son of the celebrated monk, Phipps was enabled, in 1687, to try his fortune once more, having previously engaged to divide the profit according to the twenty shares of which the subscription consisted.

At first, all his labor proved fruitless; but at last, when his patience was almost entirely exhausted, he was so lucky as to bring up, from the depth of six or seven fathoms, so much treasure, that he returned to England with the value of 200,000*l.* sterling. Of this sum he

himself got about 16,000*l.*, others say, 20,000*l.*, and the duke 90,000*l.* After he came back, some persons endeavored to persuade the king to seize both the ship and the cargo, under a pretence that Phipps, when he solicited for his majesty's permission, had not given accurate information respecting the business.

But the king answered, with much greatness of mind, that he knew Phipps to be an honest man, and that he and his friends should share the whole among them, had he returned with double the value. His majesty even conferred upon him the honor of knighthood, to show how much he was satisfied with his conduct. We know not the construction of Phipps's apparatus; but of the old figures of a diving machine, that which approaches nearest to the diving-bell, is in a book on fortification, by Lorine, who describes a square box, bound round with iron, which is furnished with windows, and has a stool affixed to it for the diver. This ingenious contrivance appears, however, to be older than that Italian; at least, he does not pretend to be the inventor of it.

After various attempts at improvement in this machine, by different people, succeeded Dr. Halley, whose bell may be sufficiently understood from the following account:—It was made of wood, containing about sixty cubic feet in its concavity, and was in the form of a truncated cone, whose diameter at the top was three feet, and at the bottom five. It was so

loaded with lead, that it could go down in a perpendicular direction, and no other. In the top was a window to let in light, and likewise a cock to let out the hot air that had been breathed; and below, about a yard under the bell, was a stage, suspended by three ropes, each of which was charged with about one hundred weight to keep it steady.

To supply air, the bell had a couple of barrels, so cased with lead as to sink when empty, each having a bung-hole in its lowest part to let in the water as the air in them condensed on their descent, and to let it out again when they were drawn up full from below. To a hole in the uppermost part of these was fixed a leathern trunk or hose, long enough to fall below the bung-hole, and kept down by a weight, in such a way that the air in the upper part of the barrels could not escape, unless the lower ends of these hose were lifted up. These air-barrels were made to rise and fall like two buckets in a well; by means of these bands fresh air was continually supplied from above, and it was done with so much ease, that two men, with less than half their strength, could perform all the labor required. By an additional contrivance, it was found practicable for a diver to go out of the engine, to some distance from it, the air being conveyed to him in a continual stream by small flexible pipes.

Great improvements have been made in the diving-bell by Mr. Walker, Mr. Spaulding, and

several other mechanical gentlemen; yet it must be acknowledged, that with all these improvements, this very curious machine appears to have been outdone, in some respects, by an invention of the famous Cornelius Drebell, if all be true that we are told about it. He contrived not only a vessel to be rowed under water, but also a liquid that would supply the want of fresh air. The vessel was made for King James I., and carried twelve rowers, besides the passengers. It was tried in the river Thames, and one of the persons who was in the vessel when the experiment was made, told it to another who gave an account of it to the ingenious Mr. Boyle.

As to the liquor, Mr. Boyle assures us, he discovered by a physician, who married Drebell's daughter, that it was used as occasion required, when the air in the submarine boat was clogged by the breath of the company, and rendered unfit for respiration; at which time, by unstopping a vessel full of this liquor, he could presently restore to the troubled air such a quantity of vital parts, as made it useful again for a considerable time. The secret of this liquor Drebell would never disclose to more than one person, who communicated the preparation to Mr. Boyle: but that gentleman seems to doubt whether the virtues of the liquor were so effectual as reported.

FORMATION OF ICE.

Ice is a brittle transparent body, formed of some fluid, frozen or fixed by cold. The specific gravity of ice to water is as eight to nine; or the specific gravity of water being one, that of ice is ninety-three; hence, being lighter than water, it floats upon it. The specific gravity of ice was tried by Dr. Irving, in Phipps's voyage to the north pole; who found that when a piece of the most dense ice which he could meet with was immersed in snow-water, the thermometer 34°, fourteen-fifteenth parts sunk under the surface of the water: in brandy just proof, it barely floated; in rectified spirits of wine, it fell to the bottom at once and dissolved immediately.

This rarefaction of ice has been supposed to be owing to the air-bubbles produced in ice while freezing; these, being considerably large in proportion to the water frozen, render the ice so much specifically lighter. Accordingly, it is said, that a considerable quantity of air is lodged in the interstices of water, though it has not there any elastic property, on account of the disunion of its particles; but these particles coming closer together, and uniting as the water freezes, light, expansive, and elastic air-bubbles are thus generated, and increase in bulk as the cold grows stronger; whence of course the ice grows lighter, and these air-bubbles acquiring an elastic force, burst to

pieces any vessel in which the water is closely contained.

But snow-water, or any water being boiled over the fire, affords an ice more solid than ordinary, and with fewer bubbles. Pure water, long kept in vacuo, and frozen afterwards there, freezes much sooner, on being exposed to the same degree of cold, than water unpurged of its air and set in the open atmosphere. And the ice made of water thus divested of its air, will expand in freezing; though it is much harder, more solid and transparent, and more ponderous, than common ice.

But M. de Mairan, in a dissertation on ice, more justly attributes the increase of the bulk of the water under this form, principally to a different arrangement of its parts: the icy skin or water, being composed of filaments which are found to be joined constantly and regularly at an angle of 60°, and which, by this disposition, occupy a greater volume than if they were parallel. He found the augmentation of the volume of water by freezing, and in different trials, a fourteenth, an eighteenth, and a nineteenth; but when the water was previously purged of air, only a twenty-second part. Besides, ice, after its formation, continues to expand by cold; a piece of ice, which was at first only a fourteenth part specifically lighter than water, on being exposed some days to the frost, became a twelfth part light-

er; and thus he accounts for the bursting of ice in ponds.

To make the most perfect ice, we should take the purest water, and perfectly purge it of its air, by the air-pump; then freeze it in the severest frost, by means of Mr. Fahrenheit's contrivance. Thus we obtain an ice of the greatest hardness, density, purity, transparency, and gravity.

It appears by an experiment of Dr. Hooke, in 1663, that ice refracts the light less than water; whence he infers, that the lightness of ice, which causes it to swim in water, is not produced merely by the small bubbles which are visible in it, but that it arises from the uniform constitution or general texture of the whole mass.

Dr. Wollaston has fully confirmed the observation of Dr. Hooke, by means of an accurate instrument which he has contrived for determining the refraction of different substances; so that ice must be considered as the least refractive of any known substances that are not aeriform. The refractive power of ice is stated by Dr. Wollaston, and by Dr. Young, by calculation, from halos, at 1.31. The capacity for heat of water to ice is as 1000 to 900; and the heat, in a given measure, is as 1000 to 840.

In the mountains of Switzerland there are immense masses of ice, which, by the tradition and histories of the country, must have lain there many centuries. At certain times there

happen cracks in these, and by these cracks the vast thickness of the masses may in some measure be guessed at; some of them being three or four hundred ells deep, and yet none of them ever having gone through the whole thickness.

The vast bodies of ice met with in the northern seas, near Hudson's bay, are surprising; some of them being immersed a hundred fathoms or more under the surface of the ocean, and a fifth or sixth part above, and three or four miles in circumference.

These floating mountains of ice owe their vast bulk and durable nature to a cause not considered by many; that is, to their not being common ice, but the ice of sea-water; many experiments proving, that in acid and spirituous liquors, when the frost has power over them, the watery parts only are affected, and the ice is tasteless, while the liquor remains concentrated, and much stronger than before at the bottom or in the centre.

It was generally supposed that the saline liquors, and consequently sea-water, were affected, by freezing, in the same manner; that is, its watery part alone was frozen, and the salt separated from the part so congealed: but Dr. Lister alleges, that the ice formed of sea-water is really salt, and does contain sea-salt; and finally that it is, by means of this salt contained in it, rendered more durable than common ice. If a vial of salt-water be exposed

to the air in frosty weather till flakes of ice are found in it, and then brought into a warm room, those flakes will remain even in that place a long time undissolved; and if they are taken out and exposed at a small distance from the fire, they will not run into water as common ice would, but they will by degrees evaporate, and there will be left only a little white salt.

Since sea-water, when frozen, thus forms a very durable ice, it appears easy to conceive, that the immense masses of such ice found in the northern seas should continue undissolved through the whole year, and at the return of the freezing season remaining of the same bigness as the first, they must of consequence then become much larger by the freezing of more ice about them; and thus continuing to lose very little, and that only by accidents, and annually to increase a great deal, it is not wonderful that they become so large.

But there have been different opinions with regard to the origin of those vast piles of ice, resembling whole islands, in the northern regions. Some ascribe them to snow, which falling in great abundance in these cold climates, and melting in the sea, accumulates gradually, till those huge heaps are at length formed: but the more common opinion is, that this ice is formed from the fresh waters which flow from the neighboring lands. It is certain that great quantities of floating ice are dis-

charged by the river Oby, and kept in a state of constant agitation by it.

Sir Robert Barker has particularly described the process of making ice in the East Indies, where, during his time, he had never seen any natural ice. For this purpose they dig, on a large open plain, three or four pits, about thirty feet square and two deep each; the bottoms of which they cover about eight inches or a foot thick with sugar-cane, or the stems of the large Indian corn, dried. On this bed are placed in rows a number of small shallow unglazed earthen pans, formed of a very porous earth, a quarter of an inch thick, and about an inch and a quarter deep; which, at the dusk of the evening, they fill with soft water that has been boiled.

In the morning, before sunrise, the ice-makers attend at the pits, and collect what was frozen, in baskets, which they convey to the place of preservation. This is generally prepared on some high dry situation, by sinking a pit fourteen or fifteen feet deep, lining it first with straw, and then with a coarse kind of blanketing. The ice is deposited in this pit, and beat down with rammers, till at length its own accumulated cold again freezes it, and forms one solid mass. The mouth of the pit is well secured from the exterior air with straw and blankets, and a thatched roof is thrown over the whole. The quantity of ice formed by the method above described, de-

pends on a light atmosphere, and clear serene weather.

REMARKABLE ICEBERGS

Icebergs are large bodies of ice filling the valleys between the high mountains in northern latitudes. Among the most remarkable are those of the east coast of Spitzbergen. They are seven in number, but at considerable distances from each other: each fills the valleys for tracts unknown, in a region totally inaccessible in the internal parts. The glaciers of Switzerland seem contemptible to these; but present often a similar front into some lower valley. The last exhibits over the sea a front five hundred feet high, emulating the emerald in color; cataracts of melted snow precipitate down various parts, and black spiring mountains, streaked with white, bound the sides, and rise crag above crag as far as the eye can reach in the background.

At times immense fragments break off, and tumble into the water with a most dreadful noise. Masses have been seen resembling a Gothic church, with arched windows and doors, and all the rich drapery of that style, composed of crystals of the richest sapphirine blue; tables with one or more feet; and often immense flat-roofed temples, like those of Luxor on the Nile, supported by round transparent columns

of cerulean hue, float by the astonished spectator. These icebergs are the creation of ages, and receive annually additional height by the falling of snows and rain, which often instantly freezes, and repairs the loss occasioned by the influence of the melting sun.

The following account of an excursion to the Seven Icebergs, in July, 1818, is given by Captain Scoresby. A strong northwesterly swell having for some hours been beating on the shore, had loosened a number of fragments attached to the iceberg, and various heaps of broken ice denoted recent shoots of the seaward edge. "As we rowed," says he, "towards it, with a view of proceeding close to its base, I observed a few little pieces fall from the top; and while my eye was fixed upon the place, an immense column, probably fifty feet square and one hundred and fifty-nine feet high, began to leave the parent ice at the top, and leaning majestically forward, with an accelerated velocity, fell with an awful crash into the sea. The water into which it plunged was converted into an appearance of vapor or smoke, like that from a furious cannonading. The noise was equal to that of thunder, which it nearly resembled. The column which fell was nearly square, and in magnitude resembled a church. It broke into thousands of pieces.

"This iceberg was full of rents, as high as any of our people ascended upon it, extending in a direction perpendicularly downward, and

dividing it into innumerable columns. The surface was very uneven, being furrowed and cracked all over. This roughness appeared to be occasioned by the melting of the snow, some streams of water being seen running over the surface; and others could still be heard pursuing their course through subglacial channels to the front of the iceberg, where, in transparent streams, or in small cascades, they fell into the sea. In some places chasms of several yards in width were seen, in others they were only a few inches or feet across. One of the sailors, who attempted to walk across the iceberg, imprudently stepped into a narrow chasm filled up with snow to the general level. He instantly plunged up to his shoulders, and might, but for the sudden extension of his arms, have been buried in the gulf."

In the first ages of the Spitzbergen fishery, when the ships sometimes moored close to the shore, many serious disasters were occasioned by the fall of pieces of icebergs. One of the Russia Company's ships, which was on the whale fishery in the year 1619, was driven on shore in Bell Sound, by ice setting in from the sea. The captain, with most of his crew and boats, was absent at the time of the accident; but, on the first intelligence, caused his boats to be hauled upon the ice, and proceeded on board to endeavor to get the ship off.

After they had been using every endeavor for this purpose, during about an hour, a main

piece of an adjoining ice-cliff came down, and almost overwhelmed the vessel and her crew in its ruins. The shock must have been tremendous. The ice which fell struck the ship so high and so forcibly, that it carried away the foremast, broke the mainmast, sprung the bowsprit, and flung the ship over with such violence, that a piece of ordnance was thrown overboard from under the half deck; and the captain and some of the crew were projected in the same way. The captain, notwithstanding his imminent danger, with fragments of ice flying in all directions, and the masts of the ship falling all around him, escaped unhurt; but the mate and two more of the crew were killed, and many others were wounded.

THE ROAR OF THE SEA

Voice of the mighty deep,
  Piercing the drowsy night,
Thou scarest the gentle sleep,
  Whose pinions will not light
Where thou intrudest busy thought,
With depths dark as thy secrets fraught.

Thy mystic sounds I hear,
  Peal of unwonted things
Of wonders far and near
  The hollow music rings,
Its notes borne wild around the world,
Where'er thy dark blue waves are curl'd.

Oh no, I cannot sleep,
  Thou vast and glorious sea
While thou dost thus the vigil keep
  Of thy great majesty,
I think God's image near me is,
In all its awful mysteries.

Thou art a spirit, Ocean, thou!
  Giant of earth and air,
Spanning the universe; and now,
  While making music here,
Ten thousand leagues afar, thy wave
Is rolling on an empire's grave!

Thine arm that shakes me here,
  Thunders upon the shore
Of North, and South, and central sphere,
  Fuego, Labrador;
From flaming Equinox to frigid Pole,
Belting the earth thy waters roll.

Ingulfing mountains at a sweep
  Beneath their angry sway,
Or raising islands from the deep
  In their triumphant way,
Or murmuring sweet round Scian isles,
In cadence soft as beauty's smiles.

'Tis midnight!—earth and air
  Are hush'd in lair and rest—
Thy energy from thy long birth
  Hath never needed rest:
Thou dost not tire—thou feel'st not toil—
Thou art not form'd, like me, of soil.

Why dost thou thunder so?
What in thy depths profound,
Thus as a strong man with his foe,
Gives out that angry sound;
On earth no foe can ever be,
Prince of creation, worthy thee!

Age thou hast never known—
Thou shalt be young and free,
Till God command thee give thine own,
And all is dumb save thee;
And haply when the sun is blood,
Unchanged shall be thy mighty flood.

WORKS OF THE CORAL INSECT.

Though some species of corals are found in all climates, they abound chiefly in the tropical regions. In particular, the larger and more solid kinds seem to have chosen those climates for their habitation; while the more tender and minute, the Flustras for example, occur in the colder seas.

These animals vary from the size of a pin's head, or even less, to somewhat more than the bulk of a pea; and it is by the persevering efforts of creatures so insignificant, working in myriads, and working through ages, that the enormous structures in question are erected.

Enormous we may well call them, when the great Coral Reef of New Holland alone is

a thousand miles in length, and when its altitude, though yet scarcely fathomed in twenty places, cannot range to less than between one and two thousand feet. It is a mountain ridge, that would reach almost three times from one extremity of England to the other, with the height of Ingleborough, or that of the ordinary and prevailing class of Scottish mountains. And this is the work of insects, whose dimensions are less than those of a house fly. It is perfectly overwhelming.

But what is even this? The whole of the Pacific Ocean is crowded with islands of the same architecture, the produce of the same insignificant architects. An animal barely possessing life, scarcely appearing to possess volition, tied down to its narrow cell, ephemeral in existence, is daily, hourly, creating the habitations of men, of animals, of plants. It is founding a new continent; it is constructing a new world.

These are among the wonders of His mighty hand; such are among the means which He uses to forward His ends of benevolence. Yet man, vain man, pretends to look down on the myriads of beings equally insignificant in appearance, because he has not yet discovered the great offices which they hold, the duties which they fulfil, in the great order of nature.

If we have said that the coral insect is creating a new continent, we have not said more than the truth. Navigators now know that

the Great Southern Ocean is not only crowded with those islands, but that it is crowded with submarine rocks of the same nature, rapidly growing up to the surface, where, at length overtopping the ocean, they are destined to form new habitations for man to extend his dominion.

They grow and unite into circles and ridges, and ultimately they become extensive tracts. This process cannot cease while these animals exist and propagate. It must increase in an accelerating ratio; and the result will be, that by the wider union of such islands, an extensive archipelago, and at length a continent must be formed.

This process is equally visible in the Red Sea. It is daily becoming less and less navigable, in consequence of the growth of its coral rocks; and the day is to come, when, perhaps, one plain will unite the opposed shores of Egypt and Arabia.

But let us here also admire the wonderful provision which is made, deep in the earth, for completing the work which these animals have commenced. And here we may note the contrast between the silent and unmarked labors of working myriads, operating by a universal and long ordained law, and the sudden, the momentary effort of a power, which, from the rarity of its exertion, seems to be especially among the miraculous interpositions of the Creator.

It is the volcano and the earthquake, that are to complete the structure which the coral insect has laid; to elevate the mountain and form the valley, to introduce beneath the equator the range of climate which belongs to the temperate regions, and to lay the great hydraulic engine, by which the clouds are collected to fertilize the earth, which causes the springs to burst forth and the rivers to flow.

And this is the work of one short hour. If the coral insect was not made in vain, neither was it for destruction that God ordained the volcano and the earthquake. Thus also, by means so opposed, so contrasted, is one single end attained. And that end is the welfare, the happiness of man.

If man has but recently opened his eyes on the important facts which we have now stated, his chemistry is still unable to explain them. Whence all this rock; this calcareous earth? We need scarcely say that the corals all consist of calcareous earth, of lime united by animal matter. The whole appears to be the creation of the animal. It is a secretion by its organs. Not only is the production of calcareous earth proceeding daily in this manner, but by the actions of the myriad tribes of shell fish which are forming their larger habitations in the same manner, and from the same material.

It is this which forms the calcareous beds of the ocean; it is this, which has formed those

enormous accumulations, in a former state of the world, which are now our mountains, the chalk and limestone of England, and the ridge of the Apennines. These are the productions of the inhabitants of an ancient ocean. Whence did it all come? We may know some day; but assuredly we do not now know.

Thus it is that we prove, that all the limestone of the world has been the produce of animals, though how produced, we as yet know not. If a polype has constructed the great submarine mountain of New Holland, the thousand tribes and myriads of individuals which inhabited the submarine Apennine might as easily, far more easily, have formed that ridge. We prove that this is the case, because we find the shells in the mountains, because we find the mountains made of shells.

A FUNERAL AT SEA.

The sun had just risen, and not a cloud appeared to obstruct his rays. A light breeze played on the bosom of the slumbering ocean. The stillness of the morning was only disturbed by the ripple of the water, or the diving of a flying-fish. It seemed as if the calm and noiseless spirit of the deep was brooding over the waters.

The national flag displayed half way down the royal-mast, played in the breeze, uncon-

scious of its solemn import. The vessel glided in stately serenity, and seemed tranquil as the element on whose surface she moved. She knew not the sorrows that were in her own bosom, and seemed to look down on the briny expanse beneath her in all the confidence and security of strength.

To the minds of her brave crew it was a morning of gloom. They had been boarded by the angel of death; and the forecastle now contained all that was mortal of his victim. His soul had gone to its final audit. Grouped around the windlass, and left to their own reflections, the hardy sons of the ocean mingled their sympathies with each other. They seemed to think of their own immortality. Conscience was at his post. And I believe that their minds were somewhat impressed with the realities of eternity.

They spoke of the virtues of their deceased messmate—of his honesty, his sensibility, his generosity. One remembered to have seen him share the last dollar of his hard-earned wages with a distressed shipmate. All could attest his liberality. They spoke too of his accomplishments as a sailor; of the nerve of his arm, and the intrepidity of his soul. They had seen him in an hour of peril, when the winds of heaven were let loose in all their fury, and destruction was on the wing, seize the helm and hold the ship securely within his grasp, till the danger had passed by.

They would have indulged longer in their reveries, but they were summoned to prepare for the rites of sepulture, and pay the last honors to their dead companion. The work of preparation was commenced with heavy hearts and with many a sigh. A rude coffin was soon constructed, and the body deposited within it. All was ready for the final scene. The main hatches were his bier. A spare sail was his pall. His surviving comrades in their tar-stained habiliments stood around.

All were silent. The freshening breeze moaned through the cordage. The main topsail was hove to the mast. The ship paused on her course and stood still. The funeral service began; and as "we commit this body to the deep" was pronounced, I heard the knell of the ship bell—I heard the plunge of the coffin. I saw tears start from the eyes of the generous tars. My soul melted within me as I reverted to the home-scenes of him whom we buried in the deep—to hopes that were to be dashed with wo—to joys that were to be drowned in lamentation.

DESCRIPTION OF THE SHARK.

Of all the animals which inhabit the deep, the shark is the fiercest and the most voracious; the smallest of this kind is considered

formidable by those fish which greatly exceed it in size; though the white shark may sometimes rank with the whale in magnitude, as many of them measure from twenty to thirty feet; and we are told that a human body has been found in their inside. The head is large, and somewhat flattened; the snout long; and the eyes fierce, extensive, and full of fire. The teeth are most terrible instruments of destruction, as the animal is known to be furnished with six rows, that amount to no less than a hundred and forty-four in number, which, when it is at rest, lie quite flat in the mouth; but, the moment it has the design of seizing upon its victim, these formidable weapons are erected in rows.

The shark is doubtless the fiercest depredator, and the greatest tyrant, that inhabits the deep; his formidable figure is calculated to intimidate, and his courage and activity are scarcely to be conceived. No other fish can swim with equal agility; for he is able to outstrip the fleetest ships, and frequently plays round them with sportive festivity, as if expecting to be regaled with some part of their contents.

A sailor who was bathing in the Mediterranean, near Antibes, in the year 1744, perceived one of these dreadful monsters approaching, and, anticipating his fate by the extension of its jaws, in an agony of terror called out to his companions instantaneously to throw him

out a rope. The rope, of course, was immediately thrown to him, and in eager agony he secured his hold; but in the very moment his messmates were dragging him to a place of security, the insidious tyrant sprang upon his leg, and grasping it between its sharp-edged fangs, in a moment severed it from his bleeding frame.

A Guinea captain was, by stress of weather, driven into the harbor of Belfast; and his unfortunate captives, when brought upon the deck for air, had many of them reposed their sorrows in the deep, from an idea that, by terminating their existence, they should be reunited to their family and friends. The savage monster under whose tyranny they were placed, enraged at the loss of so large a share of his prize, was resolved to make death appear in a more formidable shape than had hitherto been presented to the minds of those unfortunate victims of cruelty and oppression, and therefore gave orders that a young female, whom he heard had an intention of committing suicide, should gradually be let down with ropes from the side of the ship.

The minions of authority obeyed his orders, and the unresisting victim patiently submitted to his caprice; but at the moment her head alone remained above the surface of the water, she was heard to utter a most agonizing scream. The surrounding element was dyed with crimson; and the sailors, alarmed and astonished

at the sight, instantly drew the body out of the water, when it proved that a shark had divided it from the lower part of the sides. This is only one of the many instances that might be related, of the rapacious appetite of this destructive fish; but it is sufficient to create that antipathy and aversion which are universally conceived against this destructive race.

The usual methods which sailors have contrived to take them, is by baiting a large hook with a piece of beef or pork, which is thrown into the sea, attached to a stout rope, strengthened near the hook by an iron chain. The shark for some time surveys the magnet, as if fearful of the weapon, which is cautiously concealed, until the sailors, anxious to provoke it to destruction, pretend to draw the bait from the bottom to the stream, when, darting forward with furious impetuosity, he swallows the hook and part of the chain.

This is the manner in which Europeans destroy this tyrant: but the negroes along the African coast attack him merely with a knife; and, as the shark is obliged to turn before he can seize his opponent, during that action the negro plunges his knife into its sides. Upon the whole, the shark, when living, is a formidable animal; and, when it is dead, is of very little use, for its flesh can scarcely be digested by the stomach of a negro; but from the liver there may be extracted about three or four quarts of oil. Some imaginary virtues have

been ascribed to the brain; and the skin is used by cabinet-makers for polishing their work.

DESCRIPTION OF THE WHALE.

The whale is the largest of all animals of whose history we have any certain account. It is sometimes found ninety feet long; and those which inhabit the torrid zone, are said to be much larger. The size of the head is about one third of the whole fish. The under lip is much broader than the upper, which is narrow and oblong. The tongue is a soft, spongy, fat substance, sometimes yielding five or six barrels of oil. The gullet or swallow is very small for so large an animal, not exceeding four inches in width; but that is proportioned to the food it eats, which is a particular kind of small snail; or, as some say, it varies its repast with the medusa, or sea-blubber, an insect which is found in the sea.

It has two orifices in the middle of the head through which it spouts water to a great height, and, when it is disturbed or wounded, with a noise like thunder. Its eyes are not larger than those of an ox, and placed at a great distance from each other. There is no fin on the back; but on the sides, under each eye, are two large ones, which serve it for rowing. The color varies; the back of some being red; others

black; and another variety is mottled. The belly is generally white. They are extremely beautiful in the water. The skin is very smooth and slippery.

Under the skin, the whale is covered with fat or blubber, from six to twelve inches thick, which sometimes yields from one to two hundred barrels of oil. All Europe is supplied with oil for lamps, and many other purposes, from this blubber. The flesh is red and coarse, somewhat like beef; but the Greenlanders eat it; and the Icelanders soak it in sour whey for food.

Spermaceti is prepared from the oil found in the head of the whale. It is melted over a gentle fire, and put into moulds, like those wherein sugar loaves are formed. When cold and drained, it is taken out and melted over again, till it be well purified and whitened. It is then cut with a knife into flakes; and is used as a medicine, for various complaints of the lungs. It is also used for making candles, which are but little inferior to those made of wax.

The substance called whalebone adheres to the upper jaw, and is formed of thin parallel laminæ, called whiskers. Some of the longest are four yards in length. They are surrounded by long, strong hair, to guard the tongue from being hurt, and also to prevent the return of their food, when they discharge the water out of their mouths.

THE WHALE FISHERY.

Whales are chiefly caught in the North Sea. The largest sort are found about Greenland, or Spitzbergen. At the first discovery of that country, whales, not being used to be disturbed, frequently came into the very bays, and were accordingly killed almost close to the shore; so that the blubber being cut off, was immediately boiled into oil on the spot. The ships in those times took in nothing but the pure oil and the fins; and all the business was executed in the country; by which means, a ship could bring home the product of many more whales than she can according to the present method of conducting this trade. The fishery also was then so plentiful, that they were obliged sometimes to send other ships to fetch off the oil they had made; the quantity being more than the fishing ships could bring away.

Time, however, and change of circumstances, have effected that alteration in the concern, which, in every similar case, it is reasonable to expect. The ships coming in such numbers from Holland, Denmark, Hamburgh, and other northern countries, in addition to the English, who were the first discoverers of Greenland; the whales, disturbed, and gradually, as fish often do, forsaking the place, were not to be killed so near the shore as before; but are now found, and have been so ever since, in the

openings and spaces among the ice, where they have deep water, and where they go sometimes a great many leagues from the shore.

The whale fishery begins in May, and continues all June and July; and whether the ships have good or bad success, they must come away and get clear of the ice by the end of August; so that in the month of September, at farthest, they may be expected home: but a ship that meets with a fortunate and early fishery in May, may return in June or July.

The manner of taking whales at present, is as follows: as soon as the fishermen hear the whale below, they cry out, 'Fall!' 'Fall!' and every ship gets out its long-boat, in each of which there are six or seven men. They row till they come pretty near the whale; then the harpooner strikes it with the harpoon. This requires great dexterity; for through the bone of his head there is no striking; but near his spout there is a soft piece of flesh, into which the iron sinks with ease.

As soon as he is struck, they take care to give him rope enough: otherwise, when he goes down, as he frequently does, he would inevitably sink the boat. This rope he draws with such violence, that, if it were not well watered, it would, by its friction against the sides of the boat, be soon set on fire. The line fastened to the harpoon is six or seven fathoms long, and is called the forerunner. It is made of the finest and softest hemp, that it may slip

the easier. To this they join a heap of lines, of ninety or a hundred fathoms each; and when there are not enough in one long-boat they borrow from another. The man at the helm observes which way the rope goes, and steers the boat accordingly, that it may run exactly out before; for the whale runs away with the line with so much rapidity, that he would overset the boat, if it were not kept straight.

When the whale is struck, the other long-boats row before, and observe which way the line stands, and sometimes pull it. If they feel it stiff, it is a sign the whale still pulls in strength; but if it hangs loose, and the boat lies equally high, before and behind, upon the water, they pull it in gently, but take care to coil it so that the whale may have it again easily, if he recovers strength. They take care, however, not to give him too much line; because he sometimes entangles it about a rock, and pulls out the harpoon. The fat whales do not sink as soon as dead; but the lean ones do, and come up some days afterwards.

As long as they see whales, they lose no time in cutting up what they have taken; but keep fishing for others. When they see no more, or have taken enough, they begin with taking off the fat and whiskers, in the following manner: the whale being lashed along side, they lay it on one side, and put two ropes, one at the head, and the other in the place of the tail, which,

together with the fins, is struck off, as soon as he is taken, to keep those extremities above water. On the off side of the whale are two boats, to receive the pieces of fat, utensils, and men that might otherwise fall into the water on that side.

These precautions being taken, three or four men, with irons at their feet, to prevent slipping, get on the whale, and begin to cut out pieces of about three feet thick, and eight long, which are hauled up at the capstan or windlass. When the fat is all got off, they cut off the whiskers of the upper jaw with an axe. Before they cut, they are all lashed, to keep them firm; which also facilitates the cutting, and prevents them from falling into the sea.

When on board, five or six of them are bundled together, and properly stowed; and, after all is got off, the carcass is turned adrift, and devoured by the bears, who are very fond of it. In proportion as the large pieces of fat are cut off, the rest of the crew are employed in slicing them smaller, and picking out all the lean. When this is prepared, they stow it under the deck, where it lies till the fat of all the whales is on board: then, cutting it still smaller, they put it up in tubs in the hold, cramming them very full and close. Nothing now remains but to sail homeward, where the fat is to be boiled and melted down into train-oil.

The American whale fishery was commenced in Nantucket, an island in Massachusetts which

looks out upon the Atlantic, and receives upon its shores the whole sweep of the ocean. Colonized, as it first was, by an adventurous and hardy race of settlers from other parts of Massachusetts, the colonists had ample means and motives to push their enterprises upon the waters of its neighboring coasts. The first effort made was upon a whale found in their own harbor. The success of this adventure induced the people of that place to commence the enterprise of taking whales as a regular business, these animals being at that time very numerous around the coast; and, as early as 1672, we find the inhabitants entering into formal arrangements for carrying on the business. The people of Cape Cod, also, early embarked with much success in the same operations.

In order to show the progress of the whale fishery in this country, it may be proper here to state, that according to Mr. Pitkin, the quantity of sperm oil brought to our ports in 1831, was 109,200 barrels; and of common oil, 114,341; and of whalebone, 1,029,690 pounds, the total value being 3,488,632 dollars; that into the single ports of New Bedford and Nantucket, there were brought in the year 1833, 76,631 barrels of sperm oil, 84,596 barrels of common oil, and 729,759 pounds of whale bone; to which when we add the amount brought into the other ports during that year, it equals the sum of 4,046,900 dollars. Since the period

named, the business has been increasing, and has been got up at various other points where there were the requisite facilities.

The right whale, which, with the sperm, constitutes the principal object pursued by the whale fishery, is of the largest class. Many which were taken in 1761, in the Gulf of St. Lawrence, it is stated, produced two hundred and thirty barrels of oil; and as the ships then employed did not exceed sixty tons burden, the capture of a single whale constituted a full cargo. The bone from a whale of this size, sometimes weighed 3000 pounds, each of which was worth a dollar, and the slabs were frequently ten feet in length.

In the importance of the whale fishery as augmenting the wealth of the country, it is not equalled by any other species of traffic, and presents a marked example of productive labor. It adds to the stock of national wealth by drawing from the great reservoir of the ocean an immense value to the public, both for use and exchange. Hence it should be nurtured as a strong arm of domestic industry, and a severe but valuable nursery of that noble and hardy class, the seamen of the country.

THE FALLS OF NIAGARA.

About four miles above the cataract we began to see the mist, raised by the agitation of

the water, ascending in the form of a large white cloud, and continually varying its aspect, as it was blown by the wind into every fantastical shape. At times, it almost entirely disappeared; at others, it burst suddenly upon the sight; and, rising slowly, with great solemnity and grandeur, dispersed its magnificent volumes into the atmosphere. Nothing could afford us more noble anticipations of the splendor of the scene, to which we were approaching.

After dining at Chippeway, we proceeded to the cataract. About a mile from our inn, we were presented with one of the noblest prospects in the world; the more impressive, as none of us had ever heard it mentioned. Here the immense bed of limestone, which fills this country, begins rapidly to decline. A number of shelves, parallel to each other, cross the river obliquely, almost to the American shore. They are, however, irregular, broken, and wild; formed into long and short ranges, sudden prominences, and pointed rocks. Over this ragged and finely varied surface, the river rolls its amazing mass of waters with a force and grandeur, of which my own mind had never before formed a conception. The torrent is thrown up with immeasurable violence, as it rushes down the vast declivity, between two and three miles in breadth, into a thousand eminences of foam. All the magnificence of water scenery shrunk in a moment into playthings of Lilliput.

When we came over against the cataract we secured our horses, and descended the ancient bank of the river, a steep of one hundred and fifty or two hundred feet. The foot-way which conducted us was of clay; and, having been wet by the preceding rain, was so slippery that we could hardly keep our footing. At the bottom we found a swamp, encumbered with trees, bushes, mire, and water. After stooping, struggling, and sliding, near a quarter of a mile, we came to the Table Rock; a part of the stratum over which the river descends, and the edge of the precipice which at this place forms the British bank of the river. This rock is at a small distance from the cataract, and presents the spectator with as perfect a view as can be imagined.

These falls are situated twenty-one miles, reckoned on the British, and twenty-three, reckoned on the American arm of the river, (where it is divided by Grand Isle,) from Buffalo, two miles less from the outlet of Lake Erie, and fourteen miles from the entrance of the river, into Lake Ontario, between Newark and Fort Niagara. The river bends, on the American side, about twelve miles to the northwest, and, on the British side, about four, immediately below Navy Island. It is here little less than four miles wide, and sufficiently deep for any navigation. It gradually becomes narrower as it approaches the falls, but immediately above them its breadth is not far from

three miles. From one mile and three quarters above, or opposite to the Stedman farm, it begins to descend with a rapid and powerful current. At the falls it turns instantly, with a right angle, to the northeast, and in a moment is contracted to three quarters of a mile.

Below the falls the river is not more, and in some places it is less, than half a mile in breadth. Its depth here is great, being said to exceed three hundred feet; and its current is violent, proportionally to this contraction.

The cataract is formed by the brow of that vast bed of limestone which is the base of all this country. Here its surface is, perhaps, one hundred and fifty feet beneath the common surface of the earth; elsewhere it approaches nearer. The brow extends, as I am informed, into the county of Ontario on the east, and on the west into Upper Canada a distance which is unknown. The great falls of the Genesee are formed by the same brow.

On the river Niagara it approaches near to Queenstown, at the distance of seven miles below the cataract. The whole height of the ledge above Lake Ontario is estimated by Mr. Ellicott to be four hundred and ten feet. At Lake Erie the common level of the shore is about twenty feet above its waters. This level continues to the falls, and probably to the neighborhood of Queenstown; the river gradually declining, till it arrives at the rapids.

Here, within the distance of one mile and three fourths, it declines fifty-seven feet.

The precipice, over which the cataract descends, is, according to Major Prescott's survey, one hundred and fifty-one feet. This vast descent is perpendicular, except that the rocks are hollowed underneath the surface, particularly on the western side. The length of the precipice is three fourths of a mile.

At the cataract the river is divided by an island, whose brow is perpendicular, and nearly coincident with the common line of the precipice. It occupies about one fifth or one sixth of the whole breadth. This island, it is reported, was visited by General Putnam during the last Canadian war, or that which began in the year 1755. A wager, it is said, was laid, that no man in that part of the army would dare to attempt a descent upon it. Putnam, with his customary resolution, undertook the enterprise. Having made fast a strong rope to a batteau, he proceeded a considerable distance up the stream. Then, taking some stout, skilful rowers, he put out into the river directly above the island. The rope, in the mean time, was held firmly by several muscular soldiers on the shore. The batteau descended securely enough to the island, and, the enterprise being accomplished, was drawn again to the shore by his attendants.*

* A bridge now connects the island with the American shore. 1819.

The noise of this cataract has often been the object of admiration, and the subject of loose and general description. We heard it distinctly, when crossing the ferry, at the distance of eighteen miles; the wind blowing from the northwest, almost at right angles with the direction of the sound. Two gentlemen, who had lived some time at York, on the north side of Lake Ontario, and who were my companions in the stage, informed me that it was not unfrequently heard there. The distance is fifty miles.

The note or tone, if I may call it such, is the same with the hoarse roar of the ocean; being much more grave, or less shrill, than that which proceeds from other objects of the same nature. It is not only louder, but seems as if it were expanded to a singular extent; as if it filled the atmosphere, and spread over all the surrounding country. The only variety which attends it, is a continual undulation, resembling that of long musical chords, when struck with a forcible impulse. These undulations succeed each other with great rapidity.

When two persons stand very near to each other, they can mutually hear their ordinary conversation; when removed to a small distance, they are obliged to halloo; and, when removed a little farther, cannot be heard at all. Every other sound is drowned in the tempest of noise made by the water, and all else in the regions of nature appears to be dumb. This

noise is a vast thunder, filling the heavens, shaking the earth, and leaving the mind, although perfectly conscious of safety, and affected with a sense of grandeur only, lost and astonished, swelling with emotions which engross all its faculties, and mock the power of utterance.

The strength of this sound may be illustrated in the following manner: The roar of the ocean on the beach, south of Long Island, is sometimes heard in New Haven, at the distance of forty miles. The cataract of Niagara is heard ten miles farther.

All cataracts produce greater or less quantities of mist; a proof, to the common eye, that vapor may rise by mere agitation. The mist raised here is proportioned to the greatness of the cause. A large, majestic cloud, visible, from an advantageous position, for a great number of miles, rises without intermission from the whole breadth of the river below; and, ascending with a slow, solemn progress, partly spreads itself down the stream by an arching, and wonderfully magnificent motion; and partly mounts towards heaven, blown into every wild and fantastical form; when, separating into smaller clouds, it successively floats away through the atmosphere.

Nearest to the shore a considerable quantity of this vapor impinges against the rock; and, continually accumulating, descends in a constant shower of drops and little streams. A

person standing under the shelving part of these rocks, would in a short time be wet to the skin.

In the mist, produced by all cataracts, rainbows are ordinarily seen in a proper position, when the sun shines; always indeed, unless when the vapor is too rare. Twice, while we were here, the sun broke through the clouds, and lighted up, in a moment, the most lucid rainbow which I ever beheld. In each instance the phenomenon continued a long time, and left us in perfect leisure to enjoy its splendors. It commenced near the precipice, and extended, so far as I was able to judge, at least a mile down the river.

When the eye was fixed upon any spot, commencing a few rods above the precipice, that is, where the cataract begins to be formed, the descending water assumes everywhere a circular figure from the place where it begins to descend to that where it falls perpendicularly. The motion here remarkably resembles that of a wheel rolling towards the spectator. The section is about one fifth or one sixth part of a circle, perhaps twelve rods in diameter. The effect of this motion of so vast a body of water, equally novel and singular, was exquisitely delightful. It was an object of inexpressible grandeur, united with intense beauty of figure; a beauty greatly heightened by the brilliant and most elegant sea-green of the waters, fading imperceptibly into a perfect white at the brow of the precipice.

The emotions excited by the view of this stupendous scene are unutterable. When the spectator casts his eye over the long ranges of ragged cliffs, which form the shores of this great river below the cataract; cliffs one hundred and fifty feet in height, bordering it with lonely gloom and grandeur, and shrouded everywhere by shaggy forests; when he surveys the precipice above, stretching with so great an amplitude, rising to so great a height, and presenting in a single view its awful brow, with an impression not a little enhanced by the division which the island forms between the two great branches of the river; when he contemplates the enormous mass of water, pouring from this astonishing height in sheets so vast, and with a force so amazing; when, turning his eye to the flood beneath, he beholds an immense convulsion of the mighty mass, and listens to the majestic sound which fills the heavens; his mind is overwhelmed by thoughts too great, and by impressions too powerful, to permit the current of the intellect to flow with serenity.

The disturbance of his mind resembles that of the waters beneath him. His bosom swells with emotions never felt, his thoughts labor in a manner never known before. The pleasure is exquisite, but violent. The conceptions are clear and strong, but rapid and tumultuous. The struggle within is discovered by the fixedness of his position, the deep solemnity of his

aspect, and the intense gaze of his eye. When he moves, his motions appear uncontrived. When he is spoken to, he is silent; or, if he speaks, his answers are short, wandering from the subject, and indicating that absence of mind which is the result of laboring contemplation.

All these impressions are heightened to a degree which cannot be conjectured by the slowly ascending volumes of mist, rolled and tossed into a thousand forms by the varying blast, and by the splendor of the rainbow successively illuminating their bosom. At the same time, the spectator cannot but reflect, that he is surveying the most remarkable object on the globe. Nor will he fail to remember, that he stands upon a river, in most respects equal, and in several of high distinction superior, to every other; or that the inland seas which it empties, the mass of water which it conveys, the commercial advantages which it furnishes, and the grandeur of its disruption in the spring, are all suitable accompaniments of so sublime and glorious a scene.

THE ROARIÑG CASCADE, JAMAICA.

In St. Anne's parish, Jamaica, is a very remarkable cascade, or, more properly speaking, a cataract, formed by the White River, which is of considerable magnitude, and, after a

course of about 12 miles among the mountains, precipitates itself in a fall of about 300 feet or more, obliquely measured, with such a hoarse and thundering noise, as to be heard at a great distance. Viewed from below, the adjutage appears to be a body of water, of small bulk, issuing between a tuft of wood; but, as it continues its descent, the breadth gradually increases, until it reaches the bottom, where it forms a beautiful circular basin, and then flows away in a serpentine course towards the sea.

Through the whole descent it is broken and interrupted by a regular climax of steps, of a stalactitic matter, incrusted over a kind of soft chalky stone, which yields easily to the chisel. So vast a discharge of water, thus wildly agitated by the steepness of the fall, dashing and foaming from step to step, with all the impetuosity and rage peculiar to this element, exhibits an awful, pleasing scene. But the grandeur of it is astonishingly heightened by the fresh supplies which it receives after the rainy seasons.

At such times, the roaring of the flood, reverberated from the adjacent rocks, trees, and hills; the tumultuous violence of the torrent, tumbling headlong with resistless fury; and the gloom of the overhanging wood, contrasted with the soft serenity of the sky, the silvery glitter of the spray, the flight of birds skimming over the lofty summit of the mountain, and the placid surface of the basin below, form

altogether an assemblage of subjects, the most happily mingled, and beyond the power of painting to express.

Wild o'er the brim, with many a torrent swell'd,
And the mix'd ruin of its banks o'erspread,
At last the roused-up river pours along,
Resistless! roaring! dreadful!—Down it comes
From the rude mountain, and the mossy wild,
Tumbling through rocks abrupt, and sounding far.—
Then o'er the sanded valley floating spreads,
Calm, sluggish, silent;—till again constrain'd
Between two meeting crags, it bursts away,
Where rocks and woods o'erhang the turbid stream,
There gathering triple force, rapid and deep,
It boils! and wheels! and foams! and thunders through!

THOMSON.

FALLS OF MONTMORENCY.

THE Montmorency empties itself at the distance of about eight miles northeast of Quebec, into the great river St. Lawrence, to the coast of which it gradually descends from the elevated mountain on which it has its source. At a station called La Motte, situated on the northern extremity of a sloping ground, its waters diffuse themselves into shallow currents, interrupted by rocks which break them into foam, and accompanied by murmuring sounds, which enliven the solitude and solemn stillness prevailing throughout the surrounding forests and desolate hills. Farther down, its channel is bounded by precipitous rocks, its

breadth becoming extremely contracted, and the rapidity of its current proportionably augmented.

At a place called "the natural steps" there are several beautiful cascades of ten or twelve feet. These steps, which are extremely regular, have been gradually formed by the accession of waters the river receives in its progress, at the breaking up of winter, by the melting of the snows. From the middle of April to the end of May, its waters roll with increasing height and rapidity. Being powerfully impelled in their course, they insinuate themselves between the strata of the horizontal rock, vast fragments of which are detached by the rushing violence of the sweeping torrent.

On the eastern side, the bank, which is almost perpendicular, and fifty feet high, is surmounted by lofty trees. The southwest bank rises beyond the steps, and terminates in a precipice. On the opposite side, the bank is regular and of a singular shape, resembling the ruin of an elevated wall. The trees, by which the banks are enclosed, united with the effect produced by the foaming currents, and the scattered masses of stone, form a scene wild and picturesque. The stream now taking a southern direction, is augmented in its velocity, and forms a grand cascade interrupted by huge rocks.

A quarter of a mile farther down, a similar effect is produced. After exhibiting an agree-

able variety through its course, the river is precipitated, in an almost perpendicular direction, over a rock two hundred and fifty feet in height. Wherever it touches the rock, it falls in white clouds of rolling foam; and beneath, where it is propelled with uninterrupted gravitation, it forms numerous flakes, like wool or cotton, which are gradually protracted in the descent, until they are received into the boiling profound abyss beneath.

The effect from the summit of the cliff is awfully grand and truly sublime. The prodigious depth of the descent of the waters of this surprising fall; the brightness and volubility of their course; the swiftness of their movement through the air; and the loud and hollow noise emitted from the basin, swelling with incessant agitation from the weight of the dashing waters, forcibly combine to attract the attention, and to impress the mind of the spectator with sentiments of grandeur and elevation. The clouds of rising vapor, which assume the prismatic colors, contribute to enliven the scene. They fly off from the fall in the form of a revolving sphere, emitting with velocity pointed flakes of spray, which spread in receding, until they are interrupted by the neighboring banks, or dissolved in the atmosphere.

The breadth of the fall is one hundred feet; and the basin, which is bounded by steep cliffs, forms an angle of forty-five degrees. When

viewed from the beach, the cataract is seen to flow with resplendent beauty down the gloomy precipice, the summit of which is crowned with woods. The diffusion of the stream to the breadth of fifteen hundred feet, and the various small cascades produced by the inequalities of its rocky bed, on its way to the river St. Lawrence, display a very singular and pleasing combination.

FALLS OF THE MISSOURI.

The most prominent features of this great American river, which is fed by so many streams, having their sources in a great variety of soils and climates, are its wonderful falls, rapids, and cascades, the following connected view of which is abstracted from the very accurate draught and survey made by Captain Clarke.

This river is nine hundred feet wide at the point where it receives the waters of Medicine River, which is four hundred and one feet in width. The united current continues five thousand four hundred and twelve feet, somewhat more than a mile, to a small rapid on the north side, from which it gradually widens to four thousand two hundred feet, and at the distance of nine thousand and forty-two feet, (nearly a mile and three-fourths,) reaches the

head of the Rapids, narrowing as it approaches them.

Here the hills on the north, which had withdrawn from the bank, closely border the river, which for the space of a mile makes its way over the rocks with a descent of thirty feet: in this course, the current is contracted to sixteen hundred and forty feet, and after throwing itself over a small pitch of five feet forms a beautiful cascade of twenty-six feet five inches; this does not, however, fall immediately perpendicular, being stopped by a part of the rock, which projects at about one third of the distance.

After descending this fall, and passing the Cotton-wood island, on which the eagle has fixed its nest, the river goes on for eight thousand seven hundred and seventy-eight feet (more than a mile and a half) over rapids and little falls, the estimated descent of which is thirteen feet six inches, till it is joined by a large fountain boiling up underneath the rocks near the edge of the river, into which it falls with a cascade of eight feet. It is of the most perfect clearness, and rather of a bluish cast; and even after falling into the Missouri, it preserves its color for half a mile.

From this fountain the river descends with increased rapidity for the distance of three thousand five hundred and thirty-one feet, during which the estimated descent is five feet; from this, for a distance of two thousand two

hundred and twenty-seven feet, the river descends fourteen feet seven inches, including a perpendicular fall of six feet seven inches.

The river has now become pressed into a space of one thousand four hundred and nineteen feet, and here forms a grand cataract, by falling over a plain rock, the whole distance across the river, to the depth of forty-seven feet eight inches: after recovering itself, the Missouri then proceeds with an estimated descent of three feet, till at the distance of sixteen hundred and eighty-three feet it again is precipitated down the crooked falls of nineteen feet perpendicular; below this, at the mouth of a deep ravine, is a fall of five feet, after which, for the distance of sixteen thousand and five feet, (upwards of three miles,) the descent is much more gradual, not being more than ten feet, and then succeeds a handsome level plain for the space of two thousand nine hundred and thirty-seven feet, (more than half a mile,) with a computed descent of three feet, making a bend towards the north.

Thence it descends, during seven thousand nine hundred and twenty feet, about eighteen feet and a half, when it makes a perpendicular fall of two feet, which is fourteen hundred and eighty-five feet beyond the great cataract, in approaching which it descends thirteen feet, within a distance of about six hundred feet, and gathering strength from its confined channel, which is only eight hundred and forty feet

wide, rushes over the fall to the depth of eighty-seven feet and three quarters of an inch.

After raging among the rocks and losing itself in foam, it is compressed immediately into a bed of two hundred and seventy-nine feet in width; it continues for five thousand six hundred and ten feet to the entrance of a run or deep ravine, where there is a fall of three feet, which joined to the decline of the river during that course, makes the descent six feet.

As it goes on, the descent within the next three thousand nine hundred and sixty feet, is only four feet; from this, passing a run or deep ravine, the descent for one thousand six hundred feet is thirteen feet; within three thousand nine hundred and sixty feet, is a second descent of eighteen feet; thence two thousand six hundred and forty feet farther, is a descent of six feet; after which, to the mouth of Portage creek, a distance of four thousand six hundred and twenty feet, the descent is ten feet. From this survey and estimate, it results, that the river experiences a descent of three hundred and fifty-two feet in the course of two or three quarter miles, from the commencement of the rapids to the mouth of Portage creek, exclusive of almost impassable rapids which extend for a mile below its entrance.

CATARACT OF THE NILE

This celebrated river, through its long and fertile range of about two thousand British miles, in winding through abrupt and precipitous countries, exhibits very considerable cataracts, ten or twelve of which, having a descent of more than twenty feet, occur before it reaches the level of Egypt. The one which, by way of eminence, is called the *Cataract of the Nile*, was visited by Mr. Bruce, from whose relation the following particulars are extracted.

At the distance of half a mile beneath the cataract, the river is confined between two rocks, over which a strong bridge of a single arch has been thrown, and runs into a deep trough with great roaring and an impetuous velocity. On ascending, the cataract presents itself amid groves of beautiful trees, and exhibits a most magnificent and stupendous sight, such, Mr. Bruce observes, as ages, added to the greatest length of human life, could not efface or eradicate from his memory. It struck him with a kind of stupor, and total oblivion of where he was, as well as of every sublunary concern.

At the time of his visit, the river had been considerably increased by rains, and fell in one sheet of water, above half an English mile in breadth and to the depth of at least forty feet, with a force and noise which were truly terrific, and which for a time stunned

him and made him giddy. A thick fume or haze covered the fall in every part, and hung over the course of the stream both above and below, marking its track although the waters were not seen. The river, although much swollen, preserved its natural clearness, and fell, partly into a deep pool or basin in the solid rock, and partly into twenty different eddies, to the very foot of the precipice. In falling, a portion of the stream appeared to run back with great fury on the rock, as well as forward in the line of its course, raising waves or violent ebullitions which chafed against each other.

TALLULAH FALLS.

The rapids of Tallulah are in Georgia, ten miles above the union of the Tallulah and Chatooga rivers, which form the Tugaloo, five miles from South Carolina, and about twenty miles from the line of North Carolina. The river, which is forty yards wide above the rapids, is forced, for a mile and a fourth, through a range of mountains into a channel scarcely twenty feet broad.

The mountain receives the water into a broad basin, surrounded by solid rock one hundred feet in height. Here the stream pauses in anticipation of the awful gulf; then rushes down a cataract forty feet; then, hur-

rying through a narrow winding passage, dashing from side to side against the precipice and repeatedly turning at right angles, is precipitated one hundred feet—and in a moment after fifty feet more,—and then making many short turns, it rushes down three or four falls of twenty and ten feet. The sum of the fall, in the distance of a mile, is estimated at three hundred and fifty feet.

The rapids, however splendid, apart from the sublimity with which they are surrounded, are only an appendage to the stupendous banks of solid rock, descending almost perpendicularly to the water on both sides of the river, and varying in the distance of a mile from seven hundred to one thousand feet in height, so that the stream literally passes that distance *through* the mountain, or rather through the high lands that connect two mountains.

The visitor approaches from the west, finds an easy descent for the last mile, and drives his carriage to the very edge of the gulf. No unusual appearances of pointed rocks or broken lands admonish him that the rapids are near, till suddenly he sees the opening abyss. He advances cautiously from tree to tree till he looks down upon the water.

Instantly his mind surrenders itself to the overwhelming sensation of awe and amazement. He neither speaks nor smiles, and even a jest or smile from a friend is painful to the feelings; which, particularly with the ladies,

(as at the Niagara Falls,) are often relieved by weeping. Some of our company hurrying down to the brink, without giving the mind time to collect itself, experienced dizziness and faintness, and were compelled to *crawl* back.

Here are no artificial embellishments. The scenery wears the artless robe of nature's wildness. The romantic variety, magnificence, and sublimity of nature are untouched by human hands. The rapids are in the bosom of a forest, in which are seen burrows of foxes and dens of rattlesnakes, and in which are heard the howling of wolves and the screaming of eagles: there the wild deer bound gracefully through the small bushes, and pass the trees rifted by lightning.

In front of the spectator, the perpendicular face of the rock on the opposite shore, presenting an endless variety of figures and colors—brown, white, azure, and purple—over-hanging, receding, angular, and square surfaces—figures in bass-relief ornamented with shrubbery—small rivulets falling in graceful cascades down the precipice—the opening abyss, lined with massive rock—the foaming, roaring water, at the bottom, encircled by rainbows—all seen at one view, produce sensations unutterable.

The feeling once enjoyed, you desire to recall it; but it can be recalled only by placing yourself again upon the spot. Nor does the scenery lose its power by long and minute ex-

amination. I lingered about the rapids three days, and the effect was rather heightened by new discoveries than weakened by familiarity.

The most magnificent general view is from a part of the precipice which projects over the abyss twenty feet, and which is gained by a descent of fifteen feet. This is half way between the commencement and termination of the rapids, near the highest part of the mountain through which they pass, and not less than one thousand feet above the water; and it affords the best view of the second and third falls, one of which is almost under the projection.

Our company had just gained this site, sufficiently agitated with our situation, when instantly a peal of thunder burst over us and the rain descended upon us. The young ladies took shelter under a projecting bank, from which one step might have precipitated them one thousand feet into the foaming river; the rest of the party crowded under a single umbrella upon the point of the overhanging rock.

The rock house, formerly the entrance of the Indian's paradise, but now the eagle's habitation, was before us; the earth, in front and on either hand, opened wide and deep; over us roared the thunder; under us, at about the same distance, were seen and heard the pouring and dashing of the cataracts; "heaven's red artillery" played around, and the wind swept by with great violence.

At this moment, a large pine near us was rifted by the lightning and its trunk entirely splintered to the ground. Echo answered echo from side to side, rumbling long and loud through the caverns of the broken mountain. We all trembled, and looked at each other in silence. The ladies sustained the shock with unexpected equanimity, and kept their places. In half an hour the cloud passed over—the wind slept—the sun, casting its brilliant rainbows round the falls, spread over the wilderness a mild and enchanting serenity, and we pursued our discoveries with augmented interest.

CATARACT OF THE MENDER.

The cataract which constitutes the source of this river, the Scamander of the ancients, is thus beautifully described by Doctor Clarke. "Our ascent, as we drew near to the source of the river, became steep and rocky. Lofty summits towered above us in the greatest style of Alpine grandeur; the torrent, in its rugged bed below, all the while foaming on our left. Presently we entered one of the sublimest natural amphitheatres the eye ever beheld; and here the guides desired us to alight. The noise of waters silenced every other sound. Huge craggy rocks rose perpendicularly to an immense height; whose sides and fissures, to

the very clouds concealing their tops, were covered with pines. These grew in every possible direction, among a variety of evergreen shrubs; and enormous plane-trees waved their vast branches above the torrent.

"As we approached its deep gulf we beheld several cascades, all of foam, pouring impetuously from chasms in the naked face of a perpendicular rock. It is said the same magnificent cataract continues all seasons of the year, wholly unaffected by the casualties of rain or melting snow. Having reached the chasms whence the torrent issues, we found, in their front a beautiful natural basin, six or eight feet in depth, serving as a reservoir for the water during the first moments of its emission. It was so clear that the minutest object might be discerned at the bottom.

"The copious overflowing of this reservoir causes the appearance, to a spectator below, of different cascades falling to the depth of about forty feet, but there is only one source. Behind are the chasms whence the water issues. We entered one of these and passed into a cavern. Here the water appeared, rushing with great force beneath the rock towards the basin on the outside. The whole of the rock about the source was covered with moss; close to the basin grew hazel and plane-trees, above were oaks and pines, and all beyond a naked and fearful precipice."

CATARACT IN DALMATIA.

In Dalmatia, the river Cettina forms a magnificent cascade, called by the inhabitants *Velica Gubavisa*, to distinguish it from a less fall a little below. The waters precipitate themselves from a height of above one hundred and fifty feet, forming a deep majestic sound, which is caused by the echo resounding between the steep and naked marble banks. Many broken fragments of rocks, which impede the course of the river after its fall, break the waves and render them still more lofty and sonorous. By the violence of the repercussion, their froth flies off in small white particles, and is raised in successive clouds, which are scattered by the agitation of the air over the valley. When these clouds ascend directly upward, the inhabitants expect the noxious southeast wind called the sirocco.

The fall of the Staub-Bach, in the valley of Lauterbrannen, is estimated at nine hundred feet of perpendicular height; and about a league from Schaffhausen, at the village of Lauffen, in Switzerland, is a tremendous cataract of the Rhine, where that river precipitates itself from a rock said to be seventy feet in height, and not less than four hundred and fifty feet in breadth.

In Sweden, near Gottenburgh, the river Gotha rushes down from a prodigiously high precipice into a deep pit with a dreadful noise,

and with such amazing force, that the trees designed for the masts of ships, which are floated down the river, are usually turned upside down in their fall and shattered in pieces. They frequently sink so far under water, as to disappear for a quarter of an hour, half an hour, and sometimes for three quarters of an hour. The pit into which the torrent precipitates them is of a depth not to be ascertained, having been sounded with a line of several hundred fathoms without the bottom being found.

PASSAIC FALLS.

In addition to the stupendous North American cataracts already described, may be noticed the one formed by the river Passaic, which discharges itself into the sea at the northern extremity of the state of New Jersey. About twenty miles from the mouth of this river, where it has a breadth of about one hundred and twenty feet, and runs with a very swift current, it reaches a deep chasm or cleft which crosses its channel, and falls about seventy feet perpendicular in one entire sheet. One end of the cliff is closed up, and the water rushes out of the other with incredible rapidity, in an acute angle to its former direction, and is received into a large basin. It thence takes a winding course through the rocks

and spreads again into a very considerable channel.

The cleft is from four to twelve feet in breadth, and is supposed to have been produced by an earthquake. When this cataract was visited by a late British traveller, the spray formed two beautiful rainbows, primary and secondary, which greatly assisted in producing as fine a scene as the imagination can conceive. It was heightened by another fall, though of less magnificence, about ninety feet above. The falls of St. Anthony, on the river Mississippi, descend from a perpendicular height of thirty feet, and are nearly eight hundred feet in width, while the shore on each side is a level flat, without any intervening rock or precipice.

MEETING OF THE WATERS.

The meeting of certain rivers with the ocean is thus beautifully described in Malte Brun's Geography.

Rivers running into the sea present a great variety of interesting phenomena. Many form bars of sand, as the Senegal and the Nile; others, like the Danube, rush with such force into the sea, that one can, for a certain space, distinguish the waters of the river from those of the sea. The Mississippi ejects its waters with such force, that it retains the form of a

strong and rapid river even in the bosom of the Atlantic, traverses the American coast for upwards of two thousand miles, and first mingles with the ocean near the western shores of Scotland. This prodigy is denominated the Gulf Stream.

Rivers, however, sometimes experience the superior influence of the sea, which repels the waters into their bed. Thus the Seine forms at its mouth a "bar of water," and the Garonne, unable to discharge with sufficient rapidity the waters which it accumulates in a kind of gulf between Bordeaux and its mouth, exhibits this aquatic mountain, stopped by the flow of the tide, rolling backward, inundating the banks and agitating vessels.

The most sublime phenomenon of this kind is that of the giant of rivers, the Orellana, called the river of the Amazons. Twice a day it pours its imprisoned waves into the ocean. A liquid mount is thus raised to the height of one hundred and eighty feet; it frequently meets the flowing tide of the sea, and the shock of these two bodies of waters is so dreadful that it makes the neighboring shores tremble. Fishermen and navigators fly from it in the utmost terror.

After every full moon, when the tides are highest, the river seems to redouble its power and energy; its waves and those of the ocean rush against each other like the onset of two mighty armies. The banks are inundated

with their foaming waves: the rocks, drawn along like light pebbles, and borne as weapons of war almost upon the surface of the adverse tides, are compulsory participators in the conflict, by dashing against and fracturing each other. Loud noises, like the clamor of warring hosts, re-echo from island to island. One would suppose the genius of the river and the god of the ocean were contending in battle for the empire of the waves. The Indians call this phenomenon Porororca.

THE CROCODILE.

Cuvier, the celebrated naturalist, who recently died in Paris, says there are three kinds of crocodiles. They all, however, have many common characteristics. They are very large and strong, varying in length from five to thirty feet. Their bodies are very rough; their backs are covered with square scales or plates, and their sides by small round ones. When seen basking in the sun, or floating leisurely down a river, they are said to bear a striking resemblance to the rough trunks of trees. Their scales are so strong that a musket-ball cannot penetrate them. They are all amphibious.

All of them have long heads; and such is their singular structure about the head and neck, that it was formerly supposed the animal could move its upper jaw, and thus throw its

head backward upon its neck; but this opinion was erroneous. They have very wide mouths, and small tongues; and, what is very singular, the tongue is closely fastened to the bottom and sides of the mouth, in such a way that it cannot be extended in the least. They have twenty-seven teeth above, and fifteen below, which are thick at the roots and sharp-pointed at the ends, so that, when the mouth is shut, the upper teeth, except the four already described, go between the lower ones.

Each of the four paws has five toes; and each of the hinder has four; and three toes of each foot have claws or nails. The eyes are very small in proportion to the bulk of the body, and are provided with *three lids;* and under the throat are two small pouches, in which is found a strong musky substance. The color of a full-grown crocodile is blackish-brown above, and yellowish underneath. The upper parts of the legs and sides are varied with deep yellow, tinged with green. The animal has no lips, so that its huge mouth, set out with long rows of formidable teeth, with eyes always glaring, like fire, gives it a terrible appearance, and convinces the beholder, at once, that it must be a powerful and dangerous animal.

In most countries, they do not hesitate to attack, not only most other animals, but even man. They will sometimes attack a boat's crew, rearing their heads above water, and

snapping their jaws in a most fearful manner; often endeavoring to overturn the boat. They will follow vessels at sea for many days, to secure every thing of the animal kind that is thrown overboard. They decrease in numbers, but become more ferocious, as their haunts are intruded upon by man; though the piked-nosed, or smaller kind, which are still numerous in Florida and Louisiana, are not regarded as very dangerous. In South America, since the late wars have furnished them with much human flesh, they have become much more bold, ravenous, and dangerous than formerly. Thus does human ferocity aggravate that of the brute creation.

Their usual food is fish, reptiles, and carrion flesh which is thrown into the stream. They seem to prefer their food in the latter state, and, for this purpose, are known sometimes to bury their prey in the mud, till putrefaction commences. Although very voracious, they are able to subsist a long time without food. They abound most where fish and other creatures are in the greatest numbers, and seem ordained to keep down that astonishingly rapid increase of many animals which would otherwise take place. If they hear a dog bark on shore, they immediately go in pursuit of him; but they are less successful in pursuing their prey on land than in the water, on account of the shortness of their legs, the great length of their bodies, and the difficulty of turning; for

a crocodile of eighteen or twenty feet in length must describe a large circle on land in order to turn round; but in the water, they turn almost instantly, and with perfect ease.

The force with which this huge reptile darts through the water, resembles the flight of an arrow, rather than the movements of an animal. The males of this species sometimes, in the spring, have terrible battles with each other. Their gambols, whether designed as a challenge to their fellows, or as mere sport, are a curiosity. On these occasions, they are at first seen darting along as swift as lightning, for a little distance, after which they gradually move slower, till suddenly they stop, draw in water and air, which makes a rattling or gurgling in the throat, for a moment, till they fill themselves, when they blow it out of their mouth and nostrils with great force and noise, not unlike distant thunder; at the same time vibrating their tail swiftly in the air. At other times, after thus inflating themselves, they raise their head and tail above the water, and whirl round, till they lash the waves into such a foam, that they may be said to "boil like a pot."

The females make their nests upon the banks of rivers, generally in marshes, and at a short distance from the water. They are arranged somewhat like an encampment. They are obtuse cones, four feet high, and four feet thick at the base, built of mud and grass. A floor

of such mortar is first spread upon the ground, on which are placed a layer of eggs, as large as those of a hen. On these is put another layer of mortar, half a foot thick; then another layer of eggs, then mortar; and so on to the top. From one to two hundred eggs are found in a nest. The females watch the nests, and, as soon as they are hatched, the young follow the mother about, on land and in water. When basking in the sun, on shore, the young are heard whining and yelping about the mother, like young puppies.

When first hatched, they are very feeble and helpless, and, until old enough to defend themselves, are devoured by birds of prey, turtles, and even by the male alligators. The eggs are also sought by vultures; and if the female did not deposite an immense number of them, these animals would soon become extinct.

Like snakes, and most other reptiles, they have a very small brain, and will live a long time after it is destroyed. Mr. Peale one morning shot away the whole of the upper part of a crocodile's head, and, on passing the same way in the evening, the animal had crawled off. Following it a considerable way, he found it alive, and, mangled as it was, ready for battle.

The ancient Egyptians, who worshipped many animals, deified the crocodile among the rest. In the temple of Memphis, one of these reptiles was reared with great care, being

abundantly fed, adorned with jewels, and lodged in a spacious basin, having offerings and sacrifices made to him. Being thus fed and managed, the terrible reptile became sufficiently mild and tractable to be led about in ceremonial processions. When he died, his body was embalmed, and buried in the royal sepulchre.

AN ACCOUNT OF THE SEAL

The seal, in some respects, resembles a quadruped, but in its habits and manner of living, bears greater affinity to a fish. The head is round, like that of a man; but the nose is like that of an otter; and the teeth resemble those of a dog; the eyes are large, full, and sparkling; and instead of external ears, it has two holes in the head; the neck is well proportioned, and the body is thickest at the part where it joins, and from thence decreases down to the tail. It is impossible to say positively the size of this animal, as the difference between them is so very great; some measure only four feet in length, while others are known to exceed nine.

The body is covered with a thick, bristly, shining hair, which gives it the appearance of being rubbed over with oil. Some are black, others spotted; but yellow is the color which chiefly prevails. The feet are placed so close to the body that they apparently seem much

more like fins, and are covered with a membrane which conceals their shape; the hinder feet are turned backwards, and are totally useless when the creature is upon land; notwithstanding which, it moves very quickly whenever it perceives that it is pursued. The tongue is forked, like that of a serpent; and the blood is able to circulate without passing through the lungs, which enables the animal to dive under water, and yet in that situation freely respire.

Indeed, the water appears to be the seal's natural station, as it chiefly exists upon what that element will produce. This animal is found in every climate, but in the northern seas it particularly abounds; and on the rocky shores they are seen basking by thousands, whenever the weather happens to be fine. Though the generality of quadrupeds contentedly remain attached to the spot where they first drew breath, unless fear or necessity compels them to roam, the seal appears to delight in change; and, like birds of passage, migrate at stated periods of the year. On the northern coasts of Greenland, they retire in July, and, before the end of September, generally return; and the object of their excursion is supposed to be food.

In the beginning of March, they likewise disappear, and return again in about ten weeks, accompanied by their young; and previous to their setting out upon this expedition, whole

droves of them are seen together, making towards the north, and bending their course near that part of the sea where their passage seems least likely to be impeded by ice. By what route, or in what manner they return, is a circumstance utterly unknown; but it is observed that they are very fat when they leave the coast, and remarkably thin when they reappear.

The females bring forth in winter, and rear their young upon some sand bank, or rock, where they remain from twelve to fifteen days. These little animals, at the time of their birth, are white, and their hair has the appearance and flexibility of wool; while they are sucking, the female erects herself upon her hinder feet, and the young ones cling close to her sides. They are remarkable for docility and gentleness, and at the greatest distance, discover their parents' voice. Upon land, the seal is a very timid creature; though they are extremely courageous in the sea; and, in those parts where herrings are found in shoals, whole herds of these animals always reside.

The skin of the seal sells for about one dollar, and is used for shot pouches and covering trunks; but the Greenlanders chiefly pursue them for the sake of the oil, which they easily extract from the creature's fat. It is supposed that the seal goes about eight months with young: but its migration prevents it from being positively known; its length of life likewise

has not been completely ascertained, but it is supposed not to exceed fifteen or sixteen years.

A NIGHT AT SEA.

NOTHING can exceed the solemn stillness of a night at sea within the tropics, when the wind is light, and the water comparatively smooth. Few periods and situations, amid the diversified circumstances of human life, are equally adapted to excite contemplation, or to impart more elevated conceptions of the Divine Being, and more just impressions of the insignificancy and dependence of man.

In order to avoid the vertical rays of a tropical sun, and the painful effects of the reflection from the water, many of my voyages among the Georgian and Society Islands have been made during the night. At these periods, I have often been involuntarily brought under the influence of a train of thought and feeling peculiar to the season and the situation, but never more powerfully so than on the present occasion.

The night was moonless, but not dark. The stars increased in number and variety as the evening advanced, until the whole firmament was overspread with luminaries of every magnitude and brilliancy. The agitation of the sea had subsided, and the waters around us

appeared to unite with the indistinct though visible horizon. In the heavens and the ocean, all powers of vision were lost, while the brilliant lights in the one, being reflected from the surface of the other, gave a correspondence to the appearance of both, and almost forced the illusion on the mind, that our little bark was suspended in the centre of two united hemispheres.

The perfect quietude that surrounded us was equally impressive. No objects were visible but the lamps of heaven, and the luminous appearances of the deep. The silence was broken only by the murmurs of the breeze, passing through our matting sails, or the dashing of the spray from the bows of our boat, excepting at times, when we heard, or fancied we heard, the blowing of a shoal of porpoises, or the more alarming sounds of a spouting whale.

At a season such as this, when I have reflected on our actual situation, so far removed, in the event of any casualty, from human observation and assistance, and preserved from certain death only by a few feet of thin board which my own unskilful hands had nailed together, a sense of the wakeful care of the Almighty has alone afforded composure; and when I have gazed on the magnificent and boundless assemblage of suns and worlds, whose rays have shed their lustre over the scene, and have remembered that they were formed, sustained, and controlled, in all their

complex and mighty movements, by Him on whose care I could alone rely,—I have almost involuntarily uttered the exclamation of the Psalmist, "Lord, what is man, that Thou art mindful of him?"

The contemplation of the heavenly bodies, although they exhibit the wisdom and majesty of God, who "bringeth out their host by number, and calleth them all by names, by the greatness of His might," impressed, at the same time, the conviction that I was far from home, and those scenes which, in memory, were associated with a starlight evening in the land I had left.

Many of the stars which I had beheld in England, were visible here; the constellations of the zodiac, the splendors of Orion, and the mild twinkling of the Pleiades were seen; but the northern pole-star, the steady beacon of juvenile astronomical observation, the Great Bear, and much that was peculiar to a northern sky, were wanting. The effect of mental associations, connected with the appearance of the heavens, is singular and impressive.

During a voyage which I subsequently made to the Sandwich Islands, many a pleasant hour was spent in watching the rising of those luminaries of heaven which we had been accustomed to behold in our native land, but which, for many years, had been invisible. When the polar star rose above the horizon, and Ursa Major, with other familiar constella-

tions, appeared, we hailed them as long-absent friends; and could not but feel that we were nearer England than when we left Tahiti, simply from beholding the stars that had enlivened our evening excursions at home.

But although, in our present voyage, none of these appeared, the southern hemisphere exhibited much to attract attention. The stars in the Fish, the Ship, and the Centaur, the *nebulæ*, or Magellanic clouds, and, above all others, Crux, or the "Cross of the South," are all peculiar to this part of the heavens. This latter constellation is one of the most remarkable in the southern hemisphere. The two stars forming the longest part, having nearly the same right ascension, it appears erect when in the zenith, and thus furnishes a nightly index to the flight of time, and a memento to the most sublime feelings of grateful devotion.

With my fellow-voyagers I could enter into nothing like reciprocally interesting conversation on these subjects. Their legends of the nature and origin of the stars were absurd and fabulous; and my attempts to explain the magnitude, distances, or movements of the heavenly bodies, appeared to them unintelligible.

"Their souls proud science never taught to stray
Far as the solar walk or milky way."

A FIRE AT SEA.

Perhaps the most aggravating circumstances under which shipwreck can happen, are when it is occasioned by fire. It is then that death stares the mariner in the face in the most hideous form, while his means of counteracting the danger, or escaping from it, are more limited and ineffectual. Not many disasters of this nature have been so calamitous as the burning of a French East Indiaman, "*The Prince.*" She sailed from Port L'Orient, in France, on the 19th of February, 1752, on a voyage outward bound. Before the awful calamity which we are about to relate, the ship had suffered much from having been driven on a sand bank.

She had been four months at sea when, early one morning in June, she was discovered to be on fire. While the captain hastened on deck, lieutenant de La Fond ordered some sails to be dipped in the sea and the hatches to be covered with them, in order to prevent the access of air. Every one was employed in procuring water; all the buckets were used, the pumps plied, and pipes introduced from them into the hold; but the rapid progress of the flames baffled every exertion to subdue them, and augmented the general consternation.

The boatswain and three others took possession of the yawl and pushed off; but those

on board still continued their exertions. The captain boldly ventured into the hold, to ascertain, if possible, the origin of the fire; but was compelled by the intense heat, instantly to return, and had not a quantity of water been dashed over him, he would have been severely scorched. In attempting to get the long-boat out, it fell on the guns and could not be righted. Consternation now seized on the crew; nothing but sighs and groans resounded through the vessel; and the animals on board, as if sensible of the impending danger, uttered the most dreadful cries.

The chaplain of the ship, who was now on the quarter-deck, cheered the people and exhorted them to renewed exertions; but

"With fruitless toil the crew oppose the flame;
No art can now the spreading mischief tame;
Some smoked and smother'd did expiring lie,
Burn with the ship and on the waters fry!
Some, when the flames could be no more withstood,
By wild despair directed, 'midst the flood
Themselves in haste from the tall vessel threw,
And from the heat, to liquid ruin flew.
Sad choice of death! when those who shun the fire,
Must to as fierce an element retire!
Uncommon sufferings did these wretches wait,
Both burnt and drown'd, they met a double fate!"

Self-preservation was now the only object, and each one was occupied in throwing overboard whatever promised the least chance of escape. Yards, spars, hen-coops, and every thing to be met with, was seized in despair

and thus employed. Some leaped into the sea as the mildest death that awaited them; others, more successful, swam to fragments of the wreck; while some crowded on the ropes and yards, hesitating which alternative to choose. A father was seen to snatch his son from the flames and clasp him to his breast, then plunging into the waves they perished in each other's embrace.

The floating masts and yards were covered with men struggling with the watery element, many of whom now perished by balls from the ship's guns, which chanced to be loaded and were discharged as the fire reached them, thus forming a third means of destruction. The lieutenant, who had hitherto borne the misfortune with the greatest fortitude, was now pierced with anguish to see that no further hope remained of preserving the ship or the lives of his fellow sufferers. Stripping off his clothes, he designed to slide down a yard, one end of which dipped in the water, but it was so covered with miserable beings shrinking from death, that he tumbled over them and fell into the sea.

He had no sooner reached the water than he was seized by a drowning soldier. La Fond made every exertion to free himself, but in vain. Twice they plunged below the surface, but still the man held him until the agonies of death were passed, and he became loosened from his grasp. After clearing his way through

the floating bodies which covered the surface of the ocean, La Fond seized on a yard, and afterwards gained a sprit-sail covered with people, but on which he was, nevertheless, permitted to take a place. He next got on the mainmast, which having been consumed below, fell overboard, and after killing some in its fall, afforded a temporary succor to others.

Eighty persons were now on the mainmast, including the chaplain, who by his discourse and example taught the duty of resignation. Lieutenant La Fond, seeing the worthy man quit his hold and drop into the sea, lifted him up. "Let me go," said he, "I am already half drowned, and it is only protracting my sufferings." "No, my friend," replied the lieutenant, "when my strength is exhausted, but not till then, we will perish together."

The flames still continued raging in the vessel, and the fire at last reached the magazine, when the most thundering explosion took place; and nothing could be seen but pieces of flaming timber, projected aloft in the air, threatening to crush to atoms in their fall, numbers of miserable beings already struggling in the agonies of death. Lieutenant La Fond, with the pilot and master, now escaped to the yawl, and as night approached, they fortunately discovered a cask of brandy, about fifteen pounds of pork, a piece of scarlet cloth, about twenty yards of linen, a dozen of pipe staves, and a small piece of cordage. The

scarlet cloth was fitted for a sail, an oar was erected for a mast, and a plank for a rudder.

This equipment was made in the darkness of the night; but a greater difficulty yet remained; for as they had no charts or instruments of any kind, and being nearly two hundred leagues from land, they were utterly at a loss to know which way to steer. Both days and nights passed in miserable succession and no land was to be seen; the party all the while exposed to the scorching heat of the sun by day and the intense cold by night, suffering too from the extremities of hunger and of thirst.

When every thing seemed to predict a speedy termination to the sufferings of this unfortunate crew, on the third of July they discovered the distant land. It would be difficult to describe the change which the prospect of deliverance created. Their strength was renovated, and they were roused to precautions against being drifted away by the current. They reached the coast of Brazil and entered Tresson Bay. As soon as they reached the shore, they prostrated themselves on the ground, and in transports of joy rolled on the sand.

They exhibited a most frightful appearance. They were nearly naked, and, having been so long exposed to the heat and cold, and being almost starved, they were shockingly disfigured. Scarcely any thing human characterized any of them. While they were deliberating

what course to follow, about fifty Portuguese of the settlement advanced, and, seeing their wretched condition, pitied their misfortunes and conducted them to their dwellings, where they were hospitably entertained.

The chief man of the place soon came to see them and conducted them to his house, where he charitably supplied them with clothing and a plenteous meal. Though sleep was almost as necessary as food, yet these miserable men would not retire to rest until they had returned thanks for their miraculous deliverance in the church, which was half a league distant. After staying here a short time, they were conducted to Paraibo, and thence to Pernambuco, where they obtained a passage to Europe, and arrived at Lisbon on the 17th of December. Nearly three hundred persons perished in this dreadful catastrophe.

HOT SPRINGS OF ICELAND.

At about four in the afternoon, we arrived at the hot springs, called the *Geysers*. At the distance of several miles, on turning round the foot of a high mountain on our left, we could descry, from the clouds of vapor that were rising and convolving in the atmosphere, the spot where one of the most magnificent and unparalleled scenes in nature is displayed ;—

where, bursting the parted ground, Great Geyser,

"——— hot, through scorching cliffs, is seen to rise,
With exhalations steaming to the skies!"

Electrified, as it were, by the sight, and feeling impatient to have our curiosity fully gratified, Mr. Hodgson and I rode on before the cavalcade; and, just as we got clear of the southeast corner of the low hill, at the side of which the springs are situated, we were saluted by an eruption which lasted several minutes, and during which the water appeared to be carried to a great height in the air. Riding on, between the springs and the hill, we fell in with a small green spot, where we left our horses, and proceeded, as if by an irresistible impulse, to the gently-sloping ground, from the surface of which numerous columns of steam were making their escape.

Though surrounded by a great multiplicity of boiling springs and steaming apertures, the magnitude and grandeur of which far exceeded any thing we had ever seen before, we felt at no loss in determining on which of them to feast our wondering eyes, and bestow the primary moments of astonished contemplation. Near the northern extremity of the tract rose a large circular mound, formed by the depositions of the fountain, justly distinguished by the appellation of the Great Geyser, from the middle of which a great degree of evaporation was visible.

Ascending the rampart, we had the spacious basin at our feet, more than half filled with the most beautiful hot crystalline water, which was but just moved by a gentle ebullition, occasioned by the escape of steam from a cylindrical pipe or funnel in the centre. This pipe I ascertained by admeasurement to be seventy-eight feet of perpendicular depth: its diameter is, in general, from eight to ten feet; but near the mouth it gradually widens, and opens almost imperceptibly into the basin, the inside of which exhibits a whitish surface, consisting of a silicious incrustation, which has been rendered almost perfectly smooth by the incessant action of the boiling water.

The diameter of the basin is fifty-six feet in one direction, and forty-six in another; and when full it measures about four feet in depth, from the surface of the water to the commencement of the pipe. The borders of the basin which form the highest part of the mound are very irregular, owing to the various accretions of the deposited substances; and at two places are small channels, equally polished with the interior of the basin, through which the water makes its escape when it has been filled to the margin. The declivity of the mound is rapid at first, especially on the north-west side, but instantly begins to slope more gradually; and the depositions are spread all around to different distances, the least of which is near a hundred feet.

The whole of this surface, the two small channels excepted, displays a beautiful silicious efflorescence, rising in small granular clusters, which bear the most striking resemblance to the heads of cauliflowers, and while wet are of so extremely delicate a contexture, that it is hardly possible to remove them in a perfect state. They are of a brownish color, but in some places approaching to a yellow. On leaving the mound, the hot water passes through a turfy kind of soil, and by acting on the peat, mosses, and grass, converts them entirely into stone, and furnishes the curious traveller with some of the finest specimens of petrifaction.

Having stood some time in silent admiration of the magnificent spectacle which this matchless fountain, even in a state of inactivity, presents to the view, as there were no indications of an immediate eruption, we returned to the spot where we had left our horses; and, as it formed a small eminence at the base of the hill, and commanded a view of the whole tract, we fixed on it as the site of our tents.

About thirty-eight minutes past five, we were apprized, by low reports and a slight concussion of the ground, that an eruption was about to take place; but only a few small jets were thrown up, and the water in the basin did not rise above the surface of the outlets. Not being willing to miss the very first symptoms of the phenomenon, we kept walking about in the vicinity of the spring, now sur-

veying some of the other cavities, and now collecting elegant specimens of petrified wood, leaves, &c., on the rising ground between the Geyser and the base of the hill.

At fifteen minutes past eight, we counted five or six reports, that shook the mound on which we stood, but no remarkable jet followed: the water only boiled with great violence, and by its heavings caused a number of small waves to flow towards the margin of the basin, which at the same time received an addition to its contents. Twenty-five minutes past nine, as I returned from the neighboring hill, I heard reports, which were both louder and more numerous than any of the preceding, and exactly resembled the distant discharge of a park of artillery.

Concluding, from these circumstances, that the long-expected wonders were about to commence, I ran to the mound, which shook violently under my feet; and I had scarcely time to look into the basin, when the fountain exploded, and instantly compelled me to retire to a respectful distance on the windward side.

The water rushed up out of the pipe with amazing velocity, and was projected by irregular jets into the atmosphere, surrounded by immense volumes of steam, which in a great measure hid the column from the view. The first four or five jets were inconsiderable, not exceeding fifteen or twenty feet in height: these were followed by one about fifty feet,

which was succeeded by two or three considerably lower; after which came the last, exceeding all the rest in splendor, which rose at least to the height of seventy feet.

The large stones, which we had previously thrown into the pipe, were ejaculated to a great height, especially one, which was thrown much higher than the water. On the propulsion of the jets, they lifted up the water in the basin nearest the orifice of the pipe to the height of a foot, or a foot and a half; and, on the falling of the column, it not only caused the basin to overflow at the usual channels, but forced the water over the highest part of the brim, behind which I was standing.

The great body of the column (at least ten feet in diameter) rose perpendicularly, but was divided into a number of the most superb curvated ramifications; and several smaller sproutings were severed from it, and projected in oblique directions, to the no small danger of the spectator, who is apt to get scalded, ere he is aware, by the falling jet.

On the cessation of the eruption, the water instantly sunk into the pipe, but rose again immediately, to about half a foot above the orifice, where it remained stationary. All being again in a state of tranquillity, and the clouds of steam having left the basin, I entered it, and proceeded within reach of the water, which I found to be 183° of Fahrenheit, a temperature of more than twenty degrees less

than at any period while the basin was filling, and occasioned, I suppose, by the cooling of the water during its projection into the air.

The whole scene was indescribably astonishing; but what interested us most, was the circumstance that the strongest jet came last, as if the Geyser had summoned all her powers, in order to show us the greatness of her energy, and make a grand finish before retiring into the subterraneous chambers in which she is concealed from mortal view. Our curiosity had been gratified, but it was far from being satisfied. We now wished to have it in our power to inspect the mechanism of this mighty engine, and obtain a view of the springs by which it is put in motion: but the wish was vain; for they lie in "a tract which no fowl knoweth, and which the vulture's eye hath not seen;" which man, with all his boasted powers, cannot and dare not approach.

On the morning of the 29th, I was awakened by Captain Von Scheel, at twenty-three minutes past five o'clock, to contemplate an eruption of the spring, which Sir John Stanley denominates the *New Geyser*, situated at the distance of a hundred and forty yards to the south of the principal fountain. It is scarcely possible, however, to give any idea of the brilliancy and grandeur of the scene which caught my eye, on drawing aside the curtain of my tent.

From an orifice, nine feet in diameter, which

lay directly before me, at the distance of about a hundred yards, a column of water, accompanied with prodigious volumes of steam, was erupted, with inconceivable force and a tremendously roaring noise, to varied heights of from fifty to eighty feet, and threatened to darken the horizon, though brightly illumined by the morning sun. During the first quarter of an hour, I found it impossible to move from my knees, on which I had raised myself, but poured out my soul in solemn adoration of the almighty Author of Nature, to whose control all her secret movements and terrifying operations are subject; "who looketh on the earth, and it trembleth; who toucheth the hills, and they smoke."

At length I repaired to the fountain, where we all met and communicated to each other our mutual and enraptured feelings of wonder and admiration. The jets of water now subsided; but their place was occupied by the spray and steam, which, having free room to play, rushed, with a deafening roar, to a height little inferior to that of the water. On throwing the largest stones we could find into the pipe, they were instantly propelled to an amazing height; and some of them, that were cast up more perpendicularly than the others, remained, for the space of four or five minutes, within the influence of the steam, being successively ejected and falling again in a very amusing manner.

A gentle northern breeze carried part of the spray at the top of the pillar to the one side, when it fell like a drizzling rain, and was so cold that we could stand below it, and receive it on our hands or face without the least inconvenience. While I kept my station on the same side with the sun, a most brilliant circular bow, of a large size, appeared on the opposite side of the fountain; and on changing sides, having the fountain between me and the sun, I discovered another, if possible, still more beautiful, but so small as only to encircle my head. Their hues entirely resembled those of the common rainbow.

After continuing to roar about half an hour longer, the column of spray visibly diminished, and sunk gradually, till twenty-six minutes past six, when it fell to the same state in which we had observed it the preceding day, the water boiling at the depth of about twenty feet below the orifice of the shaft.

LAKE BAIKAL.

This lake is situated in the government of Irkutsk in Siberia, and, next to the Caspian Sea, is the largest expanse of water within the limits of the Russian empire.

Nowhere, perhaps, could a person who should traverse the globe meet with an object more truly interesting than the Baikal, wheth-

er we consider the rude sublimity of its scenery, or the singular phenomena which both the lake itself and the surrounding country present to the observation of the naturalist. Those who have visited this wonderful place, seem at a loss for language adequate to the feelings which it excites when first beheld. After travelling through a vast extent of country, diversified by neither lake nor sea, the traveller at length reaches a chain of rugged mountains, which, forming an immense amphitheatre, enclose a lake that stretches far beyond the reach of sight, and, by the violent agitation and dreadful roaring of its billows, sometimes assumes all the magnificence of a mighty ocean, while at other times the clearness of its unruffled bosom emulates the lustre of the finest mirror.

The traces of those tremendous concussions by which our world has once been agitated, are here extremely discernible. The lake itself can only be regarded as an enormous gulf, formed by the rending of the mountains, and intended by nature as a reservoir for her immense stores of water ; while its rocky shores bear in almost every spot the visible marks of some terrible revolution, of which they indicate, at the same time, the remote antiquity. Its channel consists of the broken fragments of hills, the largest of which still rise above the surface in the form of islands. Its coast is one heap of broken rocks piled above each other

to the height of forty fathoms. Cliffs, whose bases are sunk in unfathomable pits, lift their shattered summits to the clouds; and on the pinnacles of the loftiest mountains are found enormous stones in whimsical shapes, which could only be projected thither by some violent convulsion of the earth.

Nature seems to have exhausted herself by one great effort in forming the Baikal; for, though earthquakes are still frequent in the surrounding regions, they are in general so slight, that their shock is not felt at any considerable distance. The most remarkable effect of these earthquakes is visible in the lake itself, which, even in the serenest weather, and while its surface is smooth as glass, sometimes undergoes the most violent internal agitations. At times, too, in a particular part of the lake, a single wave will suddenly rise, which is succeeded by several others in the same spot. Most of the phenomena, indeed, observable in the Baikal, seem to be peculiar and anomalous. The state of its surface is almost entirely independent of the violent storms to which it is subject. Even in a very moderate breeze it often rages with alarming fury, while the strongest gales scarcely produce any perceptible increase of agitation.

The animal productions of the Baikal are more curious and unaccountable than the wonders of its coasts. Of these, the most remarkable is a fish entirely peculiar to this lake,

called by the Russians in that neighborhood, Solomianka, and known to naturalists by the name of *Callyonymus Baikalensis.* It exactly resembles a clue of blubber, and when exposed on a gridiron to the most gentle heat, melts so completely away, that nothing remains of it but a slender bone.

It is impossible to catch these fish in nets, nor indeed are they ever seen alive. They seem to confine themselves to the deep gulfs in the centre of the lake, and are generally thrown up to the surface in summer, during the violent hurricanes which burst from the mountains. When the lake has been strongly agitated, they are forced up in such quantities as to form a kind of parapet upon the shore. They are so rank and oily, that neither sea-fowl nor ravens will touch their carcass, and after remaining near two hours on shore, are dissolved by a slight pressure in the hand. The oil made of their blubber is sold to the Chinese, who value it highly.

Seals, likewise, abound in the Baikal,—a very remarkable phenomenon, as these animals are never seen elsewhere at any distance from the ocean, nor do they frequent rivers or lakes of fresh water. It appears probable, therefore, that they have been introduced into this inland sea by some extraordinary revolution, which has produced a considerable change in the level of the globe. Their skin is of a silver gray, and their number is so great that

no fewer than two thousand are taken annually. The hunting of these animals commences in April. They assemble in great flocks, where the rapid currents, or warm springs, make chasms in the ice, and frequently come out of the water to bask and sleep in the sunshine.

The hunters, who are perfectly acquainted with their haunts, place themselves in small sledges, which they conceal with a screen of white linen. As this screen perfectly resembles the ice, it can be moved towards the seals without alarming them ; and the hunters, who are provided with muskets, can thus approach so near as to fire upon them without the possibility of missing their aim. Another mode of catching these animals was employed when that country was visited by Mr. Bell of Antermony. Holes were cut in the ice at certain distances, and nets were extended from one hole to another by means of long poles. The seals, unable to remain longer under the ice, came to these apertures for air, and thus entangling themselves in the nets, became an easy prey.

WIGAN WELL.

About a mile from Wigan, in Lancashire, England, is a spring, the water of which burns like oil. On applying a lighted candle to the

surface, a large flame is suddenly produced, and burns vigorously. A dishful of water having been taken up at the part whence the flame issues, and a lighted candle held to it, the flame goes out; notwithstanding which, the water in this part boils and rises up like water in a pot on the fire, but does not feel warm on introducing the hand.

What is still more extraordinary, on making a dam, and preventing the flowing of fresh water to the ignited part, that which was already there having been drained away, a burning candle being applied to the surface of the dry earth, at the same point where the water before burned, the fumes take fire, and burn with a resplendent light, the cone of the flame ascending a foot and a half from the surface of the earth. It is not discolored, like that of sulphurous bodies, neither has it any manifest smell, nor do the fumes, in their ascent, betray any sensible heat.

The latter unquestionably consists of inflammable air, or hydrogen gas; and it ought to be observed that the whole of the country about Wigan for the compass of several miles, is underlaid with coal. This phenomenon may therefore be referred to the same cause which occasioned the dreadful explosion of Felling Colliery; but in the present case, this destructive gas, instead of being pent up in the bowels of the earth, accompanies the water in its passage to the surface.

PITCH LAKE OF TRINIDAD.

Near Point La Braye, Tar Point, the name assigned to it on account of its characteristic feature, in the Island of Trinidad, is a lake which at the first view appears to be an expanse of still water, but which, on a nearer approach, is found to be an extensive plain of mineral pitch, with frequent crevices and chasms filled with water. On its being visited in the autumnal season, the singularity of the scene was so great, that it required some time for the spectators to recover themselves from their surprise, so as to examine it minutely.

The surface of the lake was of an ash color, and not polished or smooth, so as to be slippery, but of such a consistence as to bear any weight. It was not adhesive, although it received in part the impression of the foot; and could be trodden without any tremulous motion, several head of cattle browsing on it in perfect security. In the summer season, however, the surface is much more yielding, and in a state approaching to fluidity, as is evidenced by pieces of wood and other substances, recently thrown in, having been found enveloped in it. Even large branches of trees, which were a foot above the level, had, in some way, become enveloped in the bituminous matter.

The interstices, or chasms, are very numerous, ramifying and joining in every direction:

and being filled with water in the wet season, present the only obstacle to walking over the surface. These cavities are in general deep in proportion to their width, and many of them unfathomable: the water they contain is uncontaminated by the pitch, and is the abode of a variety of fishes. The arrangement of the chasms is very singular, the sides invariably shelving from the surface, so as nearly to meet at the bottom, and then bulging out towards each other with a considerable degree of convexity. Several of them have been known to close up entirely, without leaving any mark or seam.

The pitch lake of Trinidad contains many islets covered with grass and shrubs, which are the haunts of birds of the most exquisite plumage. Its precise extent cannot, any more than its depth, be readily ascertained, the line between it and the neighboring soil not being well defined; but its main body may be estimated at three miles in circumference. It is bounded on the north and west sides by the sea, on the south by a rocky eminence, and on the east by the usual argillaceous soil of the country.

PETRIFYING WATERS

Alonso Barba gives an account of some petrifying waters of Peru, which greatly exceed all

those in Europe in the quantity of stony matter they contain. He tells us that they soon choke up their own passage by the stony matter they deposite there; and that all the cattle that drink of them die. He adds another story, which he probably took a little too hastily upon credit, which is, that they have moulds of the shape of our brick, which they fill with this water, and that on being exposed to the sun a few days, the water is wholly converted into a stone of the same shape; and that they build their houses and other buildings with these stones.

The river of Ayr, in Ayrshire, has been long said to possess a strong petrifying power; and the water of Ayr stones, which are nothing but wood petrified in that river, are universally known, as substances for making hones for razors. There are also several springs of this kind in Roxburghshire. "One is found," says the Rev. J. Arkle, "on the Tweed, exceedingly powerful, and containing a great quantity of water, where large masses of petrified matter appear on every side converted into solid stone."

The progress of the petrifaction is distinct and beautiful. The fog, which grows on the edge of the spring, and is sprinkled with water, is about eight inches high; the lower part is converted into solid stone; the middle appears as if half frozen, and the top is green and flourishing. The petrified matter, when

burnt, is resolved into very fine lime. The spring itself, when led over the fields in little rills, fertilizes them exceedingly.

RECIPROCATING FOUNTAINS.

Reciprocating fountains may be cited among the most curious phenomena of nature. An irregularity of flow is not uncommon in boiling springs; but there are other springs which evince a periodical influx and reflux, almost as regular as the tides of the ocean. These changes, it will be seen, frequently occur several times in a day, or even in an hour. They are ascribed to various causes, either subterraneous or superficial, but in general, springs and lakes of this description have been ascertained to communicate with others beneath, through pores or apertures of various diameters, which serve equally to carry off the waters, and to supply them afresh. In such cases, the flux and reflux of the upper head of water must necessarily depend on the state of that beneath; and the causes which alternately augment and diminish the latter, must produce a similar effect on the former.

Paderborn spring, in Westphalia, disappears twice in twenty-four hours, returning constantly, after a lapse of six hours, with a great noise, and so forcibly as to drive three mills at a short

distance from its source. The inhabitants call it *the bolderborn*, that is, the boisterous spring.

Lay-well spring, near Torbay, is about six feet in length, five in breadth, and nearly six inches deep. The flux and reflux, which are very visible, are performed in about two minutes; when the spring remains at its lowest ebb for the space of about three minutes. In this way it ebbs and flows twenty times within the hour. As soon as the water begins to rise, many bubbles ascend from the bottom; but on its falling, the bubbling instantly ceases.

Giggleswick spring, in the West Riding of Yorkshire, lies at the foot of a hill of limestone named Giggleswick Scar. Its reciprocations are irregular, both with respect to duration and magnitude, the interval of time between any two succeeding flows being sometimes greater, and at other times less, insomuch that a just standard of comparison cannot be formed. The rise of the water, in the stone trough, or cistern, which receives it, during the time of the well's flowing, is equally uncertain, varying from one inch to nine or ten inches, in the course of a few reciprocations. This spring, like the preceding one, discharges bubbles of air at the time of its flowing.

Near the *Lake of Bourget*, in Savoy, is a reciprocating spring which rises and falls with a great noise, but not at stated and regular times. After Easter, its ebbings and flowings are frequently perceived six times in an hour; but in

dry seasons not more than once or twice. It issues from a rock, and is called *la Fontaine de Merveille*, the marvellous fountation.

BROSELEY SPRING.

This celebrated boiling spring, or well, at Broseley, in Shropshire, was discovered in the month of June, 1711. It was first announced by a terrible noise in the night, there having been a remarkable thunder-storm. Several persons who resided in the vicinity, having been awakened in their beds by this loud and rumbling noise, arose, and proceeding to a bog under a small hill, about two hundred yards from the river Severn, perceived a surprising commotion and shaking of the earth, and a little boiling up of water through the grass. They took a spade, and digging up a portion of the earth, the water immediately flew up to a great height, and was set on fire by a candle which was presented to it.

To prevent the spring from being destroyed, an iron cistern has been placed over it, provided with a cover and a hole in the centre, through which the water may be viewed. If a lighted candle, or any burning substance, be presented to this aperture, the water instantly takes fire, and burns like spirit of wine, continuing to do so as long as the air is kept from it; but on removing the cover of the cistern it quickly

goes out. The apparent boiling and ascent of the water of this spring, are still more obviously the result of hydrogen gas, or inflammable air, than in the preceding instance of Wigan well.

MUD LAKE OF JAVA.

The following details relative to the volcanic springs of boiling mud in Java, are extracted from the Penang Gazette.

"Having received an extraordinary account of a natural phenomenon in the plains of Grobogna, fifty paals northeast of Solo, a party set off from Solo the 25th September, 1814, to examine it.—On approaching the dass or village of Kuhoo, they saw between two tops of trees in a plain, an appearance like the surf breaking over rocks with a strong spray falling to leeward. Alighting, they went to the 'Bluddugs,' as the Javanese call them. They are situated in the village of Kuhoo, and by Europeans are called by that name. We found them," says the narrator, "to be an elevated plain of mud about two miles in circumference, in the centre of which, immense bodies of soft mud were thrown up to the height of ten to fifteen feet, in the form of large bubbles, which, bursting, emitted great volumes of dense white smoke. These large bubbles, of which there were two, continued throwing up and bursting seven or eight times in a minute;

at times, they threw up two or three tons of mud. The party got to the leeward of the smoke, and found it to stink like the washings of a gun-barrel. As the bubbles burst, they threw the mud out from the centre, with a pretty loud noise, occasioned by the falling of the mud on that which surrounded it, and of which the plain is composed. It was difficult and dangerous to approach the large bubbles, as the ground was all a quagmire, except where the surface of the mud had become hardened by the sun;—upon this, we approached cautiously to within fifty yards of one of the largest bubbles, or mud-pudding, as it might properly be called, for it was of the consistency of custard-pudding, and was about a hundred yards in diameter:—here and there, where the foot accidentally rested on a spot not sufficiently hardened to bear, it sunk, to the no small distress of the walker.

"We also got close to a small bubble, (the plain was full of them, of different sizes,) and observed it attentively for some time. It appeared to heave and swell, and when the internal air had raised it to some height, it burst, and the mud fell down in concentric circles; in which state it remained quiet until a sufficient quantity of air again formed internally to raise and burst another bubble, and this continued at intervals of from about half a minute to two minutes.

"From various other parts of the pudding

round the large bubbles, there were occasionally small quantities of sand shot up like rockets to the height of twenty or thirty feet, unaccompanied by smoke: this was in parts where the mud was of too stiff a consistency to rise in bubbles. The mud at all places we came near was cold.

"The water which drains from the mud is collected by the Javanese, and, being exposed in the hollows of split bamboos to the rays of the sun, deposites crystals of salt. The salt thus made is reserved exclusively for the use of the emperor of Solo; in dry weather it yields thirty dudgins of 100 catties each, every month, but in wet or cloudy weather, less.

"Next morning we rode two and a half paals, to a place in a forest called Ram-am, to view a salt lake, a mud hillock, and various boiling pools.

"The lake was about half a mile in circumference, of a dirty-looking water, boiling up all over in gurgling eddies, but more particularly in the centre, which appeared like a strong spring. The water was quite cold, and tasted bitter, salt, and sour, and had an offensive smell.

"About thirty yards from the lake stood the mud-hillock, which was about fifteen feet high from the level of the earth. The diameter of its base was about twenty-five yards, and its top about eight feet, and in form an exact cone. The top is open, and the interior keeps con-

stantly boiling and heaving up like the bluddugs. The hillock is entirely formed of mud which has flowed out of the top. Every rise of the mud was accompanied by a rumbling noise from the bottom of the hillock, which was distinctly heard for some seconds before the bubble burst; the outside of the hillock was quite firm. We stood on the edge of the opening and sounded it, and found it to be eleven fathoms deep. The mud was more liquid than at the bluddugs, and no smoke was emitted either from the lake, hillock, or pools.

"Close to the foot of the hillock was a small pool of the same water as the lake, which appeared exactly like a pot of water boiling violently; it was shallow, except in the centre, into which we thrust a stick twelve feet long, but found no bottom. The hole not being perpendicular, we could not sound it without a line.

"About 200 yards from the lake were two very large pools or springs, eight and twelve feet in diameter; they were like the small pool, but boiled more violently and stunk excessively. We could not sound them, for the same reason which prevented our sounding the small pool.

"We heard the boiling thirty yards before we came to the pools, resembling the noise of a waterfall. These pools did not overflow—of course the bubbling was occasioned by the

rising of air alone. The water of the bluddugs and of the lake is used medicinally by the Javanese.

THE FOUNTAIN OF VAUCLUSE.

This fountain, one of the most celebrated in Europe, is situated about five miles from Avignon ; its waters are sweet and limpid, but it is only accessible by passing over frightful precipices. Its vicinity is covered with beautiful woods, whose cool refreshing shades breathe delicious odors. Near this fountain was the residence of the celebrated Italian poet, Petrarch, whose verses are full of fire and pathos. He sung, by turns, his fair mistress, Laura, the fountain of Vaucluse, and his beautiful hermitage. Laura was not less admired for her virtue and talents, than for the graces of her person. The name of Petrarch naturally calls to mind that of Laura, Vaucluse, the sweets of friendship, the pleasures of retirement, and the Muses.

The fountain of Vaucluse flows from a vast cave, at the foot of a rock of an amazing height and perpendicular as a wall. This cavern, where the hand of man never labored, is 100 feet high, and at least as much in extent ; it forms a double cave ; the exterior measures 60 feet in height at the entrance, the interior 30. Here reigns a dread silence, and

utter darkness, which inspires involuntary horror. In this second cavern there is a sheet of water so pure that we could not find, (observes a celebrated traveller,) by the light of our torches, the rock along which it passes in the least discolored.

Some daring persons, in the beginning of the last century, ventured in a small boat to sound this vast gulf; but they were unsuccessful, probably because the strength of the water carried the lead still towards the surface. A few steps from the outward cavern, the fountain finds an extensive issue, whence it rushes with impetuosity over great rocks, forming various cascades, till, meeting no obstacle, it divides gently into two large branches, in the midst of a beautiful country, and at last falls into the Rhone, under the name of the Jorque.

FOUNTAIN AT PEROUL.

There is a remarkable fountain at Peroul, near Montpellier, in Languedoc, which boils up furiously in small bubbles. This manifestly proceeds from a vapor breaking out of the earth; for upon digging near it, and pouring water upon the place newly dug, the same bubbling immediately ensues; and in several dry places thereabouts, are found small ventiducts, or spiracles, at which a steam issues

forth, strong enough to remove light bodies, such as straws, leaves, or feathers. It is observable, that this vapor does not take fire upon the application of a lighted candle, like the fumes emitted from the boiling spring near Wigan, in Lancashire.

FOUNTAIN AT PLINANIA.

At Plinania, in the country of the Grisons, is a singular fountain, which bursts from a rock, and falls in natural cascades into the lake of Como. This spring ebbs and flows thrice every day, with surprising regularity, except in stormy weather. From being almost dry, it gradually rises till it forms a considerable stream, and then as gradually subsides, till the period of its swell returns. Pliny's description of its ebb and flow is written upon the wall of an adjoining apartment.

CASCADE IN THE GARDENS AT CHATSWORTH.

Near the south and southeast sides of the house, are those water-works, which, about sixty years ago, gave the gardens of Chatsworth extraordinary celebrity. The principal of these is a cascade, which consists of a series of steps, extending a considerable distance down a steep hill, crowned at the top by a

temple, that is supplied with water from a very capacious reservoir.

This fane (says Mr. Warner) should be dedicated to Mercury, the god of deceit, as a piece of roguery is practised upon the incautious stranger within its very sanctuary, from the floor of which a multitude of little fountains spout up, while he is admiring the prospect from the portal, and quickly wet him to the skin. When this cascade is put in motion, the water rushes with prodigious force from the roof and ornaments of the temple, and falling into a basin in front of the building, is thence discharged down the flight of steps.

Among the other curiosities of this nature are a triton and some sea-horses, from whose heads small streams issue; a fountain, which throws up water to the height of 90 feet; and a copper tree, representing a decayed willow, from every leaf of which water is made to issue, by the turning of a cock, so as to form an artificial shower.

THE FALL OF STAUBBACH.

At Lauterbruennen, in Switzerland, is a celebrated torrent called the Fall of Staubbach, which rolls perpendicularly from so vast a height, as to resolve itself into a fine spray, resembling a cloud of dust; and from this appearance it takes its name, which means a

spring of dust. The greatest part of the water falls clear over the overhanging mountain during its whole descent; but the remainder dashes, about half way, against a projection of the rock, and flies off with great violence. The perpendicular height is said to be about 930 feet. When the sun shines in an opposite direction, a small rainbow is reflected towards the bottom of the fall, which gradually diminishes as the spectator approaches.

REMARKABLE CASCADES IN SWITZERLAND.

On the west side of a lake near Weddenschweil is a cascade, which, bursting from surrounding trees, falls a few feet on the ridge of rock, and then precipitates itself in mid-air for about 50 feet, without touching the sides of the precipice. The effect is peculiarly striking; nor can a contemplative spectator sufficiently admire the vast amphitheatre of rock, the sunbeams playing on the falling waters, and the noise of the torrent, contrasted with the tranquil beauties of the adjacent lake.

The cascade of Arpenas, in the neighborhood of Magland, rushes from an impending rock, with a fall of 300 feet perpendicular: it is divided into an almost imperceptible spray; and afterwards collecting itself, trickles down the sides of the mountains in a thousand little

streams. Mr. Cox observes, that this body of water is much more considerable than that of Staubbach, and that the fall appeared quite as high.

LAKE VETTER.

Among the lakes of Sweden, that called Vetter is so remarkable, in many respects, that it deserves particular attention. It divides East and West Gothland, being in length, from north to south, above 80 miles, and about 18 broad in the middle, growing narrower towards each extremity. The water of this lake is very clear, and in some places so deep, that it has been sounded with 300 fathoms of line without finding the bottom.

For the most part it is free from rocks, and has but few islands, the principal of which is Visingsoe, lying in the middle of the lake. It is often disturbed by storms, and sometimes so suddenly, that the surface begins to be ruffled before the least breath of wind is perceived, so that the cause seems to proceed from the bottom of the waters; and it is no uncommon thing for boats to be tossed by a storm in one part of the lake, while others at a small distance enjoy a perfect calm.

That such eruptions and agitations of the water are promoted by subterraneous winds, seems to be confirmed by various phenomena;

for immediately before a storm, and while the sky is yet clear, there is perceived a noise like thunder in the lake, which is always followed by a tempest. Of this the inhabitants of Visingsoe are more sensible than any others; for from that part of the island whence the wind will blow the next day, they hear a confused noise like the firing of cannon; and when this rumbling is heard in the east, it is generally followed by rain and hail.

Some people have likewise observed, while the water has been very calm, a great number of little clouds, like so many darts, rising up from the bottom of the lake, which, uniting in the air, form a kind of mizzling rain; whence it plainly appears, that this is, in a great measure, owing to subterraneous winds. To such winds, also, together with those from above, we may attribute the sudden thawing of the ice in the spring, which one minute is strong enough to bear horses and sledges, and the next is broken to pieces.

The strange noise of the waters which precedes this terrible eruption, warns travellers to make the best of their way; but those who happen to be at a great distance from land are immediately drowned, or float upon shoals of ice till they meet with relief; and what is still more dangerous, the least blast of wind will sometimes sink the ice suddenly to the bottom.

The violent under-currents of water observed in this lake are also very surprising, which,

directly opposing the winds and waves, give the fishermen a great deal of trouble. From these, as well as from its unfathomable depth and subterraneous winds, it is supposed to have a communication under ground with another large lake, called Venner, about 40 miles to the westward ; and this seems to be confirmed by several whirlpools that lie between these lakes, two of which have been sounded, and found of a vast depth. What further countenances this opinion is, that some years, without any visible cause, the waters increase, and decrease again the following year, as several persons have observed.

In the vicinity of this lake is a spring called the Hungry or Prophetic Fountain, because the peasants assert that it never has plenty of water but when there is a scarcity of corn the following year. It lies in a valley encompassed with sandy hills, and has this peculiarity, that in a rainy season it is commonly dry, whereas in the driest summers it sometimes overflows the highway near Vadstein. In 1685, which was a very wet year, this spring was quite dried up ; but the next summer, which was not so rainy, it was observed to increase ; and in the remarkably dry summer of 1705, when all the neighboring springs entirely failed, this had a plentiful stream of water.

Cataracts are frequent in the rivers of Sweden ; but the most noted of all, and the only

one worth giving an account of, is that within a few leagues of Gottenburg; where a river, which issues from the lake Venner, falls down a prodigious high precipice into a deep pit, with a terrible noise, and with such violence that large masts, which are floated down the river to Gottenburg, frequently dive so far under water by the fall, if they happen to pitch endways, that some are half an hour, others three quarters, and some a whole hour before they rise up again to the surface. Many attempts have been made to find the depth of this hole, with lines of several hundred fathoms, but no bottom could ever be discovered.

CIRENITZ LAKE.

None of the curiosities in Germany are more surprising than the Cirenitzer sea, or lake, in Carniola, so called from the neighboring town of Cirenitz. This lake is four or five miles in length, and about two in breadth, surrounded, at some distance, with mountains, which are richly clothed with wood, and abound with deer, wild-boars, hares, and other game. It is said, that in this lake a person may sow and reap, hunt and fish, within the space of a year; but this is the least remarkable circumstance belonging to it, and is no more than may be said of almost any other spot that is overflowed at certain seasons.

The most wonderful circumstance is its ebbing and flowing. The former always happens in a long drought, when it runs off through eighteen holes at the bottom, which form so many eddies or whirlpools. Valvasor mentions a singular mode of fishing in one of these holes, and says, that when the water is entirely run off into its subterraneous reservoirs, the peasants venture with lights into that cavity, which runs in a hard rock, three or four fathoms under ground, to a solid bottom; whence the water running through small holes, as through a sieve, the fishes are left behind, caught, as it were, in a net provided by nature.

On the first appearance of its ebbing, a bell is rung at Cirenitz, upon which all the peasants in the neighboring villages, with the utmost diligence, prepare for fishing; for the fish seldom stay till the water is considerably decreased. Above a hundred peasants exert themselves on this occasion, and both men and women promiscuously run into the lake without any covering, though both the magistrates and clergy have used their endeavors to suppress this indecent custom, particularly on account of the young lay-brothers of a neighboring convent who have the privilege of fishing there, and, notwithstanding the prohibitions of the fathers, leave the convent to see this uncommon spectacle. At these ebbings, an incredible number of pikes, trout, tench, eels, carp, perch, &c., are caught in the lake; and

what are not consumed, or disposed of while fresh, are dried by the fire.

Though the whole lake is left dry, except two or three pools, yet, upon the return of the water, it abounds in fish as much as it did before ; and the fishes that return with the water are of a very large size. It is also remarkable that when it begins to rain hard, three of the cavities spout up water to the height of twelve or eighteen feet ; and if the rain continue, and be accompanied with violent thunder, the water bubbles out of the holes through which it had been absorbed, and the whole lake is again filled in 24, and often in 18 hours. Sometimes not only fish, but live ducks, with grass and fish in their stomachs, have emerged from these cavities.

OF THE BOTTOM OF THE SEA.

Though the bottom of the ocean is in some places a plane ; in some very hollow, like a valley ; in others variegated with hill and dale, as on land ; yet some parts are very frightful, as appears from the following account. It is told by Kircher, that in the time of Frederick, king of Sicily, there lived a celebrated diver, whose name was Nicholas, and who, from his amazing skill in swimming and perseverance under water, was surnamed the Fish.

The curiosity of this king had long been ex-

cited by the accounts he had heard of the bottom of the Gulf of Charybdis; and he conceived that it would be a proper opportunity to have more certain information, by getting Nicholas to take a view of it. He therefore commanded our poor diver to examine the bottom of this dangerous whirlpool; and, as an excitement to his obedience, he ordered a golden cup to be flung into it.

Nicholas, though not insensible of the danger, yet influenced by various motives, soon jumped into the gulf, and was instantly swallowed up in its bosom. He continued a long while under the water, during which time the king and his attendants remained on the shore, anxious to see what would become of him; when, to their great surprise, he appeared, buffeting upon the surface, holding the cup in triumph in one hand, and making his way good among the waves with the other.

It may be supposed he was received with great applause upon his arrival on shore; the cup was made the reward of his adventure: the king ordered him to be taken proper care of, and as he was weary and overcome by his labor, after a hearty meal, he was put to bed and permitted to refresh himself further by sleep. Having been restored to his usual vigor, he was brought to the king to give a narrative of the wonders he had seen: and, after observing he would never have obeyed the king's command if he had known half the

danger, his account was to the following effect.

There were four things, he said, that rendered the gulf terrible, not only to men, but to the fishes themselves: first, the force of the waters bursting up from the bottom, which requires great strength to resist; secondly, the abruptness of the rocks, that on every side threatened sudden ruin; thirdly, the force of the whirlpool dashing against the rocks; and fourthly, the number and magnitude of polypus fish, some of which appeared as large as a man, and which, everywhere sticking against the rocks, projected their fibrous arms to entangle him.

Being asked how he was able so readily to find the cup, he replied, that it happened to be thrown by the waves into the cavity of a rock against which he himself was forced in his descent. This account, however, did not satisfy the king's curiosity. Being requested to venture once more into the gulf for further discoveries, he at first refused: but the king being desirous of having the most exact information possible of all things to be found in the gulf, repeated his solicitations, and to give them still greater weight, produced a larger cup than the other, and added also a purse of gold.

Upon these considerations, the unhappy Nicholas once more plunged into the whirlpool, and was never heard of more. The above not

only sets forth the dreadful appearance of the bottom of the sea, but serves as a lesson of virtue, to repress our presumption and thirst after gold.

FORMATION OF PEARLS.

Pearls are produced by a testaceous fish of the oyster kind, which lives in the waters of the East and West Indies, and in other seas in warm latitudes. They are found in some parts of the globe in clusters of a great number, on rocks in the depth of the sea. Such places are called pearl-banks, of which the most famous are near the coast of Ceylon, and that of Japan, and in the Persian Gulf, near the island of Bahreim or Bahrem; near the coasts of Java, Sumatra, &c., the pearl is also found. The finest and most costly pearls are the Oriental. Some consider pearls to be unfructified eggs, others a morbid concretion or calculus, produced by the endeavor of the animal in the shell, to fill up holes in the shell; others consider pearls as mere concretions of the juice of which the shell has been formed, and with which the animal annually augments it.

The worth of a pearl is in proportion to its magnitude, round form, fine polish, and clear lustre. The largest are of the size of a small walnut; but these are very rare. Those of the size of a cherry are found more frequently,

yet still very rarely. Pearls are round, pear-formed, onion-formed, and irregularly shaped. The small ones, sold by weight, are called ounce-pearls, the smallest, seed-pearls; these are converted into powder.

In Europe, pearls of "white water" are the most sought for; the Indians and Arabians prefer those of "yellow water." Some have a lead color, some incline to black, some are totally black. Pearls are found in the Elster, a river in the Voigtland, in the kingdom of Saxony, from its origin down to the small town Elsterberg, as well as in the rivulets which fall into the Elster. Since 1621, a pearl fishery has been established there; of course for the benefit of the sovereign. Also in the river Watawa, in Bohemia, and in the Moldau river, from Krumau to Frauenberg, pearls are found, sometimes of great beauty, and difficult to be distinguished from the Oriental pearl. The fishery there is the property of the owner of the land. There are also pearl fisheries on the coasts of Scotland.

Even in antiquity, pearls were an object of luxury. A pearl which Pliny valued at about $375,000 of our present money, Cleopatra is said to have dissolved at a banquet, and drunk off to Antony's health. Another, called *la peregrina*, was given to Philip II. of Spain. It was oval, and of the size of a pigeon's egg, and was valued at 80,000 ducats. Pearls were formerly used in medicine; but their medicinal

operation is not different from that of any other calcareous earth.

Linnæus discovered how to produce artificial pearls from the common river mussels, but the process has never been published, nor has it ever come into use. The shells of the pearl oyster are the substance called mother-of-pearl. There is a very curious passage in Philostratus, in which Apollonius the philosopher relates, that the inhabitants of the shores of the Red Sea, after having calmed the sea by means of oil, dove after the shell-fish, enticed them, by means of some bait, to open their shells, and having pricked the animal with a sharp-pointed instrument, received the liquor that flowed from them in small holes made in an iron vessel, in which it hardened into real pearls.

The Chinese at present cause a certain kind of mussels to form pearls. In the beginning of summer, when the mussels repair to the surface of the water, and open their shells, five or six small beads made of mother-of-pearl, and strung on a thread, are thrown into each of them. At the end of the year, when the mussels are drawn up and opened, the beads are found covered with a pearly crust, in such a manner that they have a perfect resemblance to real pearls; and the truth of this, says Beekmann, in his History of Inventions, cannot be doubted.

THE PEARL FISHERY.

The origin of procuring this valuable ornament for the person, must have arisen from accidentally discovering the pearl within oysters taken for food, it is evident; but it is impossible to ascertain when the search became systematical, though it is extremely probable that it has been so for very many ages.

The pearl-oysters of the coast of Ceylon are all of one species, and possess the same regularity of form; but they assume different qualities and have different denominations, suited to the nature of the ground where they are situated, and from the appearance of zoophytes adhering to the external surface of their shells. They resemble a cockle in shape, which is an imperfect oval, and their circumference is generally about nine inches and a half, having a segment as it were cut off where the joint of the two shells occurs. The interior of these is far more brilliant and beautiful than the pearl they enclose; and the outside is smooth, except when injured by the usurpations of sponges, corals, and other marine productions. The flesh of the animal is white, and of a glutinous consistency. Perhaps no class of animated nature undergoes more unmerited persecution and destruction than the pearl-oyster; when situated in their native regions, they afford a foundation for the habitations of other animals, and millions of them are dragged

from their banks and thrown away for what they are vainly supposed to contain, and that an intruder or a disease. One of the banks of Ceylon furnishes oysters to which zoophytes are attached, apparently belonging to the class of sponges, and these generally resemble a funnel or cup, and grow to a size that completely overshadows the oyster; others of different banks have a substance adhering to them tinged with red. The above are found to contain the finest pearls: some escape free from encumbrance, and thousands are compelled to bear trees of coral on them of five times their own weight.

The oyster is fastened to the rocks at the bottom of the sea by quantities of hairy fibres. By this means they are not readily swept from their original station, and yet possess the advantage of being conveyed to some distance from it by the motion of the water; besides, they are connected to each other in the same manner. It frequently happens that an old oyster, surrounded by young ones, is brought up by the divers, and the latter have been ascertained to possess, even when little larger than a grain of sand, the power of moving themselves by the extension and contraction of what is termed the beard. The violence of the waves at the time of the monsoons occasions great changes in the state of the banks, when incredible numbers of them are buried by the shifting sand, and that is sometimes

removed by the same power acting in a contrary direction.

It is supposed from many concurring circumstances, that the pearl-oyster arrives at maturity at the close of seven years; after this period it is imagined that it dies, when the body decaying is washed away by the sea. A bed was discovered a few years since composed almost wholly of empty shells.

When the pearl is in a state of perfection they are of a brilliant white; some have been found of a beautiful tint of pink, of the color of gold, and a few entirely black. These variations are, however, very uncommon.

The pearls are discovered near the angles of the shells and close to the hinge, where the animal is most thick and fleshy; they are generally numerous, and in some instances 150 have fallen from one oyster; on the other hand, a hundred oysters have been opened whence a pearl could not be extracted fit for any purpose whatever. Attempts were made some years past to transplant this species of oysters, but without success, as they invariably died during their transportation.

The first step previously to a fishery is the examination of the banks, which takes place at the end of October, during the short interval of fine weather usual between the close of the southwest monsoon and the commencement of the northeast. One pilot, two divers, and eight or more sailors to each boat, are em-

ployed upon this service, and there are generally nine boats. The superintendent on the part of the government accompanies the principal *arripanaar*, or pilot, who is taught his profession from his infancy, inheriting it from his father in the manner of most occupations in the East.

The boats visit the bank in a body, and the divers frequently descending ascertain its exact position, and at the same time bring up a thousand or more oysters as specimens, which are examined by persons who from experience are enabled to judge whether it is probable they are of an age calculated to answer the purposes of the intended fishing; this examination is not, however, deemed sufficient, and the oysters are opened, when the pearls are extracted, and after sorting them they are valued.

In the progress of this preliminary part of the operation, the oysters are found at various periods of growth; those not more than one year old are very small, being less than an inch in circumference, and the full-grown oysters are as large as the palm of the hand of a man; between the ages of four and five years the seed-pearl only is discovered; but after this period they increase in size very rapidly, and, as has been before observed, they die after the eighth year. After completely satisfying themselves as to the probability of future success, the result is published for the infor-

mation of those who may be inclined to partake of the probable advantages. Since the island of Ceylon has been made a part of the British empire, each fishing season has either been reserved for the exclusive use of government, or rented to speculative persons; but the produce has never amounted to £200,000 on any one occasion. The most common practice is to farm the season to an individual, who lets the right of partaking to others.

The fourteen banks or beds on which the oysters are found, are situated at the bottom of the Gulf of Manaar, and are included in a space about thirty miles in length from north to south, and twenty-four in breadth. It has been ascertained that the largest of these beds is ten miles long and two broad; the remainder are much smaller, nor are they all equally productive, as it seldom happens that more than three beds can be marked for use in any given season. The spots where the oysters lie are not raised higher than the surrounding parts except by their accumulation, and the coral rocks on which the most valuable are placed are on a level with the sand; the depth of water over them varies from eighteen to ninety feet, and the most convenient and best fishing is at the depth of between six and eight fathoms.

When it is thought proper to undertake a fishery, advertisements are issued in the English and Malabar languages, inviting the pos-

sessors of boats suited for the purpose and all divers, to meet on the 20th of February in the Bay of Condaatchy; vessels of this description assemble from various places on the coast of Coromandel, completely equipped and furnished with every necessary for the accomplishment of their intentions; these are open, of about one ton burden, forty-five feet in length, seven or eight wide, and three feet deep in the hold; and are so constructed as to draw not more than eight or ten inches of water, unless they are heavily laden, and are navigated with one sail only. They have a complement of twenty-three men, whose employments are thus appropriated: one pilot; one man for the helm; another to take care of the boat; one to lade out water; ten divers; ten mundrees, who haul up the divers, the stones, and the baskets; and a peon attends upon the part of the renter, to take care that his interests do not suffer from fraud.

A second examination of the banks takes place a few days before the operations begin, which is merely for the purpose of anchoring buoys to point out the situation of the banks, and those parts of them most abounding with the object of search. A small sloop is from the first stationed in the centre of the banks, where she remains for the double purpose of guarding the buoys and as a guide to the boats.

The pilot-boats make a circuit of twelve or fifteen miles round the sloop, sounding and

sending down the divers, and upon discovering a place remarkable for the number of oysters, a buoy is immediately placed over it, which consists of triangular rafts of wood, fastened by a cable attached to a wooden anchor sunk by two stones. The rafts support flags of various colors; and drawings of these are inserted in a book, where a minute description is given of the name, quality, and age of the oysters on the bank under each flag.

Mr. Cordiner, from whose late excellent account of Ceylon we have extracted most of the preceding particulars, says, "As the boats arrive at Condaatchy to be employed in the fishery, they are regularly numbered, and their description and the names of their crew are registered in a book. The fishery for the season of 1804 was let by government to a native of Jaffnapatam, who had resided for some years previously to it on the coast of Coromandel. For thirty days' fishing, with 150 boats, he came under an obligation to pay 300,000 Porto Novo pagodas, or £120,000 sterling. He sold the right of fishing to some of the best equipped boats for 3000 pagodas each, and that of others for 2000; but kept by far the greater part of them to fish on his own account."

After every arrangement is completed and the boats are ready to put to sea, their navigators and the divers are roused from their slumbers by the discharge of a cannon, the sounding of horns, and the beating of a kind

of drum called by the natives tom-toms; this signal is generally made rather before midnight, when a breeze from the land prevails; the confusion that immediately follows the movements of upwards of six thousand persons in the dark may be better conceived than described; but in defiance of every obstacle, these silly people will not depart till they have performed certain ablutions and incantations, calculated as they suppose to forward their views. When they have reached the banks they cast anchor and wait the approach of day, which no sooner arrives than each boat takes its station: at six or seven o'clock the diving commences. To facilitate this operation, a species of open scaffolding is projected from each side of the vessel, and it is from the scaffold the tackle is suspended, three stones on one side and two on the other. The author we have just mentioned gives so clear and comprehensive an account of this dangerous business, which he saw performed, that we shall give part of it in his own words.

"The diving-stone hangs from over by a light country rope and slip-knot, and descends about five feet into the water. It is a stone of 56lbs. weight, of the shape of a sugar loaf. The rope passes through a hole in the top of a stone, above which a strong loop is formed, resembling a stirrup iron, to receive the foot of the diver," who is entirely naked, except a piece of enbrio wrapped round his waist;

swimming near the side of the vessel, he takes the rope in one hand and places his foot in the stirrup on the stone; a basket is then thrown into the water to him, made of a hoop and network below it, in which he places the other foot.

After preparing his lungs for ceasing to breathe, he presses his nostrils firmly with one hand, and with the other pulls the rope forming the slip-knot; the stone carries him instantly to the bottom, where he no sooner arrives than he disengages himself from the stirrup, which, with the stone, is immediately drawn up by the people in the boat. The diver throws himself forward upon his face, and grasps every thing in his way as rapidly as possible, and putting it into the basket gives a signal when it is full by pulling the rope, when that also is hauled up; he then ascends by the rope, and frequently arrives at the surface before the basket; such is the consequence of custom, that though the diver cannot descend again without an interval of rest, he seldom enters the boat, remaining swimming and floating about during the whole day.

Besides the other dangers peculiar to this pursuit, the divers are liable to be devoured by sharks; but whatever may be the cause, an accident seldom occurs, which these superstitious people attribute to the powerful aid of shark charmers, without whom and their diabolical incantations they will on no account

undertake their labors. The most experienced diver has never been known to remain longer than one minute and a half under water, in which time he may gather 150 oysters, if they are numerous; but he sometimes gains not more than from five to a dozen, accompanied by coral, pieces of rock, and other substances, for he has no time to separate and examine what he seizes. When 300 boats are employed in the fishery, it is supposed that at least 1500 divers are constantly descending, the noise of which resembles the incessant roaring of a cataract. The return of the fleet in regular order, at one or two, P. M., and their arrival, with the crowds waiting to welcome their return, presents a very animating and gratifying spectacle.

After the most valuable pearls are selected, they are sent to be drilled; a most ingenious and delicate operation, which is thus performed: a piece of wood in the shape of an inverted cone is placed upon three legs, raising it about one foot from the ground; holes of various dimensions are made in the surface to receive the pearls. The person who drills sits close to the machine; he then drives the pearls steadily into their sockets; "a well-tempered needle is fixed in a reed five inches long, with an iron point at the other end, formed to play in the socket of a cocoa-nut shell, which presses on the forehead of the driller. A bow is formed of a piece of bamboo and a string.

The workman brings his right knee in a line with the machine, and places on it a small cup, formed of a part of a cocoa-nut shell, which is filled with water to moderate the heat of friction. He bends his head over the machine, and applying the point of the needle to a pearl sunk in one of the pits, drills with great facility, every now and then dexterously dipping the little finger of his right hand in the water, and applying it to the needle without impeding the operation. In this manner he bores a pearl in the space of two or three minutes, and in the course of a day perforates 300 small, or 600 large pearls."

There are different methods of fishing for pearls practised in other parts of the world; but as the Ceylon fishery eclipses them all, and the simplicity of the invention is so obvious, it would be well if it were universally adopted.

THE SEA-SERPENT.

The existence of an enormous marine animal of the serpent shape, and thence called Sea-serpent, or Sea-snake, is mentioned by Pontoppidan, a Danish bishop, in his Natural History of Norway, and has since been noticed by some voyagers. He says that these creatures make their appearance in the months of July and August, which is their spawning

time, when they come to the surface in calm weather. If the wind raises the waves, they descend. Numerous persons, he observes, agree very well in the general description of the animal; and he thinks it very strange that any one should doubt the existence of it.

In writing of the sea-serpent, Pontoppidan quotes a letter he had received from Mr. Tuchsen of Heroe. He says, the whole animal is of a dark-brown color, but is speckled and variegated with light streaks or spots, that shine like tortoise-shell; that, if any one inquires how many folds may be counted in a sea-snake, the answer is, the number is not always the same, but depends upon the various sizes of them—five-and-twenty is the greatest number I find well attested. He also says these creatures shoot through the water like an arrow out of a bow, seeking constantly the coldest places.

Within the last thirty years, a great number of persons, among them many mariners, have asserted, in the most undoubting manner, that they have seen a similar creature on the coasts of the United States, chiefly on those of New England. By different witnesses, the size of the animal has been differently estimated at from one hundred, or one hundred and twenty to forty-five feet in length; but all accounts agree in regard to the protuberances on its back, its vertical sinuosities, and its serpent-shaped head. A more particular account of

the appearance and habits of this animal, as far as they have been observed, may be found in Professor Silliman's Journal of Science for April, 1820, and in the Natural History compiled from Buffon, Cuvier, and others, published at Boston, 1831. An abstract of this account is annexed.

In the year 1804, a letter was addressed by Alden Bradford, LL.D., to the Hon. John Q. Adams, transmitting several documents, tending to establish the fact, that a large sea-serpent had been seen in and near the Bay of Penobscot, at various times. The first of these documents is a letter from the Rev. A. Cummings, of Sullivan, dated August 17, 1803, to another clergyman, Mr. H. McLean, with some remarks by the latter. The second is another letter, dated August, 1804, from Mr. Cummings to Mr. Bradford.

The sea-serpent was seen by Mr. Cummings, his wife, daughter, and another lady, as they were on their passage to Belfast, between Cape Rosoi and Long Island. It was in the month of July; the sea was calm; there was very little wind; and the first appearance of the serpent was near Long Island. Mr. C. supposed it to be a large shoal of fish, with a seal at one end of it; but he wondered the seal should rise out of the water so much higher than usual: as he drew near, they discovered the whole appearance to be one animal in the form of a serpent. He had not the horizontal,

but an ascending and descending serpentine motion. This account also refers to the descriptions given by other persons of similar animals seen by people on Fox Island, in Penobscot Bay, at different times, at Ash Point—at or near Boothbay—at Muscongus Bay—and off Meduncook.

The declaration of Eleazer Crabtree is then given, who lived at Fox Island, in the Bay of Penobscot, in the year 1777 or 1778. He had frequently heard of a sea monster frequenting the waters near the shore; and doubting the fact, he went down one day upon receiving information from a neighbor, that he was then in the sea near his house. He saw a large animal in the form of a snake, lying almost motionless in the water, about 500 feet from the bank where he stood. His head was about four feet above the surface; he appeared 100 feet long; and he supposed him to be three feet in diameter. Many other inhabitants, upon whose veracity he could depend, had also declared to him that at other times they had seen such an animal.

The following statements relate to more recent appearances of the sea-serpent. He was seen on the 20th of June, 1815, by Elkanah Finney, a respectable mariner, at Warren's Cove, near Plymouth, Massachusetts. Mr. Finney had always been accustomed to foreign voyages and fishing; and had frequently seen whales and various species of large fish. He

deposed on oath, in August, 1817, that he first saw something which appeared to the naked eye like drift sea-weed. He then looked through a perspective glass, and saw it was an aquatic animal, unknown to him. It was in rapid motion northwardly, about a quarter of a mile from the shore. At first it showed a length of about thirty feet, but in turning, about half a mile off, it displayed at least one hundred feet.

It afterwards came nearer, when it stopped and lay entirely still on the surface for five minutes, or more. The appearance was like a string of buoys, thirty or forty of which of about the size of a barrel were exhibited. The head appeared to be six or eight feet long, and where it was connected with the body was larger than the body, but it tapered off to the size of a horse's head. The body was of a deep brown or black color, but the tail was not visible. The sea was calm, the wind light, and the sky clear.

The frequent visits made by this anomalous creature to the harbor of Gloucester, in the year 1817, have probably rendered him more notorious than any other circumstance connected with his history. The first information which the inhabitants of Gloucester received of the presence of the serpent in their harbor, was obtained from the master of a coasting vessel, belonging to George's river, Maine. He reported, early in August, that he had been frightened by a huge serpent lying alongside

of his vessel; his head appeared to be resting on the cable, and his tail extending beyond the stern. The vessel, according to her rate of tonage, must have been about sixty feet long. The account was discredited, and the master sought refuge from ridicule on board his sloop.

A subsequent relation given by Amos Story, a respectable man, living upon the extreme of the harbor, excited the curiosity, though it was not calculated to remove the doubts of the inhabitants. On the 10th of August, he saw a strange animal, which he believed to be a serpent, moving rapidly through the water, and elevating his head, which was shaped like that of a sea-turtle, about a foot above the surface. He continued in sight for an hour and a half. His color was of a dark brown, and his circumference was about equal to that of a man's body. He (Mr. Story) saw fifty feet of his length, but did not discover any bunches upon his back. During the month of August he was seen by a variety of different individuals, eleven or twelve of whom observed him at distances varying from forty to eight hundred feet. In most cases, where he was seen near, he did not show his body more than from twelve to twenty feet out of water, in which instances the protuberances were not evident, but those persons who saw 60, 70, or 90 feet of his length, all mention his joints, rings, bunches or swells; and one gentleman in particular, who saw him lying still, observed

these bunches very distinctly, about one foot in height, upon his back.

Captain Toppan, and two of his crew, on board the Laura, of Newburyport, saw his head within 30 or 50 feet, and describe it with minuteness. It was formed like that of a serpent, his tongue was thrust out, and appeared about two feet in length; this he raised several times over his head, and then let it fall again; it was of a light brown color, and the end of it resembled a harpoon. The eye was like that of an ox, and there appeared to be a small bunch over it on each side of his head. The animal did not appear to be disturbed by the vessel, and his motion was much swifter than that of any whale.

When he contracts his joints in a propelling motion, his folds appear rugged and bristling with life; but when he ceases to move, his scales enclose, and he seems to be comparatively smooth. He swims underneath the water with greater rapidity than when his body is exposed to view upon the surface. The head has been described as a terrific object; its dark-brown color is mixed with some streaks of a lighter hue, and it is likened in its hard and scaly appearance to a "weather-beaten rock." One person, Mr. Gaffeny, at Gloucester, a good marksman, fired at him with his gun at thirty feet distance, with a ball eighteen to the pound, which he supposed must have taken effect, though the ball might, and proba-

bly did turn aside, in consequence of glancing upon his scales.

In the summer of 1818 the sea-serpent was seen off Cape Ann. On one occasion, when he was encountered by Captain Webber and others, two harpoons were thrown at and struck him, but without making any incision. Several balls were also fired at him, with no effect but making him dive under water. On another of his appearances in the harbor, a boat went off with muskets, and they fired at him seven or eight times, but knew not whether they hit him. Apparently they did not hurt, however; for though on the firing he went under water, he soon rose again, and played about on the surface as before.

Mr. Hodgkins, a very intelligent man of about fifty years of age, who had followed the sea all his life, made the following statement. It is dated Gloucester, Aug. 18, 1818. He says—"Returning from Newburyport into Squam harbor, on Wednesday last, in Chebacco boat, where we had been for the purpose of obtaining fishing bait, and having failed to get a supply, we were in hopes of taking some on our passage. When off Chebacco bar, it being perfectly calm, we discovered something, at the distance of a mile or more, which we were in hopes was a shoal of bait, making a great agitation on the smooth surface of the water. It seemed to approach us rapidly; when it came nearer, we were

convinced we had been in error, and what we took for a shoal of blackfish was nothing less than the bunches on the back of the celebrated sea-serpent. He made directly for the boat until he came within fifty yards; he then sunk under water, and we were much alarmed lest he should rise under us, as we had no power of getting from him, we lying becalmed.

"When he came up he was thirty feet from us, and we had a perfect view of him. His head was elevated from three to five feet; the distance from his neck to the first bunch was about six feet. We counted twenty bunches, and supposed them on an average about five feet apart. When we first saw him, there appeared a rippling in the water, which made a noise not unlike water running rapidly over loose pebbles. On his nearer approach, we found it was the ripple made by the bunches on his back. It was 12 o'clock, noon, when we saw him; the weather clear and the sea smooth. His head was of a dark-brown color, formed like a seal's, and had a glossy appearance. His body was of the size of a 60 or 80 gallon cask."

During the summer of 1819, and especially during the month of August, the serpent was seen more frequently than ever before, and by large numbers of people of the most unquestionable credit. The following is one among a multitude of statements that appeared in the

Columbian Centinel, published at Boston. It is dated Brookline, Aug. 19, 1819.

The writer says—"I got into my chaise about 7 o'clock in the morning to come to Boston, and on reaching the long beach, observed a number of people collected, and several boats pushing off, and in the offing. As my curiosity was directed towards the boats, to ascertain the course they were taking, my attention was suddenly arrested by an object emerging from the water at the distance of about 100 or 150 yards, which gave to my mind, at the first glance, the idea of a horse's head. As my eye ranged along, I perceived, at a short distance, eight or ten regular bunches or protuberances, and at a short interval three or four more. I was now satisfied that the sea-serpent was before me; and, after the first moment of excitement produced by the sight of so strange a monster, tasked myself to investigate his appearance as accurately as I could.

"My first object was the head, which I satisfied myself was serpent-shaped. It was elevated about two feet from the water, and he depressed it gradually to within six or eight inches as he moved along. I could always see under his chin, which appeared hollow underneath, or to curve downward. His motion was at that time very slow along the beach, inclining towards the shore. He at first moved his head from side to side, as if to look about him. I did not see his eyes, though I have no

doubt I could have seen them if I had thought to attend to this. His bunches appeared to me not altogether uniform in size; and as he moved along, some appeared to be depressed, and others brought above the surface, though I could not perceive any motion in them.

"My next object was to ascertain his length: for this purpose I directed my eye to several whale-boats at about the same distance, one of which was beyond him, and by comparing the relative length, I calculated that the distance from the animal's head to the last protuberance I had noticed would be equal to about five of those boats. I felt persuaded by this examination that he could not be less than eighty feet long; and as he approached the shore, and came between me and a point of land which projects from the eastern part of the beach, I had another means of satisfying myself on this point.

"After I had viewed him thus attentively for about four or five minutes, he sunk gradually into the water and disappeared; he afterwards again made his appearance for a moment at a short distance.

"My first reflection, after the animal was gone, was, that the idea I had received from the description you gave of the animal you saw off Gloucester in 1817, was perfectly realized in this instance, and that I had discovered nothing which you had not before described. The most authentic testimony given

of his first appearance there, seemed remarkably correct, and I felt as if the appearance of this monster had been already familiar to me.

"After remaining some two or three hours on the beach without again seeing him, I returned towards Nahant, and in crossing the small beach had another good view of him, but at a greater distance. At this time he moved more rapidly, causing a white foam under the chin, and a long wake, and his protuberances had a more uniform appearance. At this time he must have been seen by two or three hundred persons on the beach and on heights each side, some of whom were very favorably situated to observe him."

This description is from the pen of Samuel Cabot, and is addressed to Col. T. H. Perkins, of Boston. The authenticity of this account we shall not attempt to strengthen, but other interesting particulars of the same appearance might be selected from a large mass of unquestionable testimony. The following is extracted from a letter of James Prince, Esq., U. S. Marshal of the District of Boston, to the Hon. Judge Davis, of that city, dated Aug. 16, 1819. The scene described took place at Nahant.

"His head appeared about three feet out of water. I counted thirteen bunches on his back —my family thought there were fifteen. He crossed three times at a moderate rate across

the bay, but so fleet as to occasion a foam in the water. My family and self, who were in a carriage, judged that he was from fifty and not more than sixty feet in length. As he swam up the bay, we and the other spectators moved on and kept nearly abreast of him. I had seven distinct views of him from the long beach, and at some of them the animal was not more than 100 yards distant. On passing the second beach, we were again gratified beyond even what we saw in the other bay, which I concluded he had left in consequence of the number of boats in the offing in pursuit of him. We had here more than a dozen different views of him, each similar to the other, —one, however, so near that the coachman exclaimed, 'See his glistening eye.'"

It is well known that some persons seem to disbelieve in the existence of the sea-serpent; but testimony like the above might be found to fill a volume, and of the first respectability. Captain West, of Hallowell, who commanded the packet Delia, saw the sea-serpent engaged in fight with a whale. The serpent used his tail for a weapon of warfare, which he raised to the height of 25 or 30 feet, and with which he would strike the whale with tremendous force. The contest was fierce, and minutely described by the captain, as well as by a Mr. Schmid of Philadelphia, and others who were on board the Delia. The particulars would occupy too much space for this article; but

they may be found in the appendix to the fourth volume of the work named.

ANIMAL LIFE IN THE SEA.

It is in its animal productions that we receive the most lively impressions of the vast, the almost boundless fertility of the sea; a fertility, compared with which the whole of the land and all its inhabitants, numerous and varied as they are, sink into absolute insignificance. We might arrive at some such conclusion as this beforehand, by reflecting on the peculiar structure of the sea, and on the vast extent of the earth's surface which it occupies; and when we come to consider this great question of the productiveness of the waters, we must include the lakes and rivers, and every body of water which contains a living inhabitant, whether that water is salt or fresh, or whether it is stagnant or in motion. This is not the place for enumerating, far less describing, the animals of the deep and of its tributary waters; but it is impossible to overlook one or two of the leading facts, or to have any thing like a correct notion of the inducements which we have to the study of the sea, without taking them, however briefly, into consideration.

In the first place, excepting a certain limited space around each pole, and probably there

only for a limited depth below the surface, the sea knows no winter which can be considered as a provisionless season, to some part at least of its living inhabitants; and as we descend in latitude, its action throughout the year becomes more and more uniform, until there is in the tropical sea a much more perennial abundance than there is in those favored isles of the east, which are rendered at once so fertile and so salubrious by the continual play of the sea winds over their surfaces.

In the second place, and independently altogether of its greater extent in breadth, there is a depth of inhabitableness and production in the sea, to which, in the nature of things, there can be nothing responding upon the land. Say, that over the whole extent, the average depth to which the sea can be inhabited is only thirty fathoms,—fish have been taken at, at least, double this depth; but as the case needs no overstraining, we shall take it as much within the limit, in order to make allowance for the banks and shallows. The whole of this depth, throughout every inch, is equally inhabitable by fishes; and as their specific gravity is beautifully adapted to that of the water, they can breathe with perfect ease, or without effort, at every inch throughout this depth.

If nearer the surface, they are no doubt subjected to a smaller pressure; and if deeper, to a greater: but the pressure, so long as the

whole body of the fish is covered with water, is very nearly the same in every part of it; and we know, from our own experience, that we feel much more energetic under an increase of atmospheric pressure, and languid as that pressure is removed, unless there is a bracing influence of cold which shall make up the difference. When we ascend to a mountain-top, we have the advantage of this cold; though even there the small vessels in the lips, nostrils, and other places which are kept warm by the act of breathing, are apt to burst and bleed in consequence of the removal of pressure. And if we remain at the same elevation, and at the same temperature or a higher one, the diminished atmospheric pressure produces languor, and we feel heavy because the atmosphere around us is light. Thus there is a far more extensive range for the inhabitants of the sea than there is for those of the land.

It may, however, appear to such as have not reflected on the subject, that there may be a want of subsistence; for we are so much accustomed, from what we observe around us, to connect subsistence with the mere surface of the earth, or that which immediately grows out of this surface or is attached to it, that we may not be able, very readily, to bring ourselves to understand how there can be countless millions of living creatures, "faring sumptuously every day," over those unfathomable depths of the ocean, when probably not one

of them ever approaches within several miles of the bottom. This difficulty instantly vanishes, however, when we consider,

Thirdly, the extraordinary productive powers of the inhabitants of the sea, especially of many of the fishes—indeed of all of them—as compared with any animals upon land, except such as are of diminutive size, and remarkable for the short period of their lives. The produce of one cod-fish, in a single season, is nearer four millions than three; and though we have no evidence of the fact, and such analogies as we are able to draw from land animals are rather against it, it is not improbable that this immense production may be repeated every year. The year is the general cycle of production among most of the tribes of nature; and among the mammalia on land, though we know many instances in which it is much shorter than this, we believe that the elephant is the only well-authenticated one in which it is longer.

This productiveness is not confined to the fishes, but extends to the smaller inhabitants of the sea; and during the proper season, a pin's point can hardly be put down on the rocks favorable to production, without touching some little shell or other living creature in a rudimental state; every bit of seaweed, too, whether fixed or floating, has its numerous colonies, all in progress towards maturity; and even the water, when it presents nothing

to the naked eye, and is merely a little turbid to the microscope, (if the power of that instrument is not all the greater,) is full of life of some sort or other; and if we boil it, it gives out that peculiar odor which is common to almost every animal of the sea, when in a recent state, and which cannot be mistaken for any other.

PRESSURE OF THE SEA.

If a piece of wood which floats on the water be forced down to a great depth in the sea, the pressure of the surrounding fluid will be so severe, that a quantity of water will be forced into the pores of the wood and so increase its weight, that it will no longer be able to float or rise to the surface. Hence the timbers of ships, which have foundered in a deep part of the ocean, never rise again to the surface, like those which are sunk near the shore.

A diver may with impunity plunge to certain depths in the sea, but there is a limit beyond which he could not live under the pressure to which he is subjected. For the same reason it is probable that there is a depth below which fishes cannot live. They have, according to Joshlin, been caught at a depth at which they must have sustained a pressure of eighty tons to each square foot of the surface of their bodies.

THE FROZEN CREW

——"Miserable they
Who here entangled in the gathering ice
Take their last look at the descending sun.
While full of death, and fierce with ten-fold frosts,
The long, long night, incumbent o'er their heads:
Too horrible."—THOMSON.

THERE are fearful wonders on the ocean—wonders in the tempest, and in the calm, in the tropical heat, and in the cold and frozen seas. Thousands and tens of thousands go down into the deep, and are no more seen forever. A more fearful fate has befallen a thousand sons of the ocean. Long before the idea of the existence of a new world was contemplated by Europeans, the northern seas had been traversed in every direction by the daring freebooters of the north, who often bore the title of "the kings of the sea." They had discovered Iceland, and the settlement there formed became an asylum for the hosts of northmen, who were driven from Scandinavia by the gradual approach of southern civilization.

In time, Iceland also sent forth her colonies, and early in the tenth century effected a settlement on the coast of Greenland. It long languished for want of a sufficient population; in 988, Ericke Rande, an Icelandic chieftain, fitted out an expedition of twenty galleys, at Snaefell, and having manned them with sufficient crews of colonists, set forth from Iceland, bound to what appeared to them a more con-

genial climate. They sailed upon the ocean fifteen days, and saw no land.

The next day brought with it a storm, and many a gallant vessel sunk in the deep. Mountains of ice covered the waters as far as the eye could reach, and but few galleys of the fleet escaped destruction. The morning of the seventeenth day was clear and cloudless. The sea was calm, and far away to the north could be seen the glare of ice-fields reflecting on the sky. The remains of the scattered fleet gathered together to pursue their voyage. But the galley of Ericke was not with them. The crew of the galley which was driven farther north than the rest, reported, that as the morning broke, the huge fields of ice that had covered the ocean, were driven past them by the currents, and that they beheld the galley of Ericke Rande borne with a resistless force, and with the speed of the wind, before a tremendous flake of ice.

Her crew had lost all control over her, they were tossing their arms in wild agony. Scarcely a moment elapsed ere it was walled in by a hundred icy hills, and the whole mass moved forward and was soon beyond the horizon. That the galley of the narrators of this story escaped was wonderful. It remained, however, uncontradicted, and the vessel of Ericke Rande was never seen more.

Half a century after this event, a Danish colony was established on the western coast

of Greenland. The crew of the vessel that carried the colonists thither, in their excursion into the interior, had crossed a range of hills that stretched to the northward; they had approached, perhaps, nearer to the pole than any succeeding adventurers. Upon looking down from the summit of the hills, they beheld a vast and almost interminable field of ice undulating in various places and formed into a thousand grotesque shapes. They saw, not far from the shore, the figure of an icy vessel with a glittering icicle in place of a mast arising from it.

Curiosity prompted them to approach, when they beheld a dismal sight. Figures of men in every attitude of wo were upon the deck, but they were icy things. One figure alone stood erect, and with folded arms leaning against the mast. A hatchet was procured and the ice split away, and the features of a chieftain were disclosed; pallid and deathly, but free from decay. This was doubtless the vessel, and that figure the form of Ericke Rande. Benumbed with cold, and in the agony of despair, his crew had fallen around him. He alone had stood erect while the chill of death passed over them.

The spray of the ocean and the falling sleet had frozen as it lighted upon them, and covered each figure with an icy robe, which the short-lived glance of a Greenland sun had not power to dissolve. The Danes gazed upon the spectacle with trembling.

They knew not but the same might be their fate. They kneeled down upon the deck and uttered a prayer in their native tongue for the frozen crew, then hastily left the place, for the night was fast approaching.

ELECTRIC EEL, OR GYMNOTUS.

Of the gymnotus tribe, some of the species inhabit the fresh water and others the ocean, and with the exception of three of them, all are confined to the continent of America. It is from three to five feet in length, and ten or twelve inches in circumference in the broadest part of the body; and has the capability of swimming backward as well as forward. Their color is an olive green, and the head yellow mingled with red. The head is flat, and the mouth wide and toothless. From the point of its tail to within six inches of its head, extends a fin about two inches deep, and which is an inch thick at its junction with the body. As there are several annular divisions, or rather rugæ, of the skin across the body, it would seem that the fish partakes of the vermicular nature, and can contract or dilate itself at pleasure.

The electrical shock is conveyed either through the hand, or any metallic conductor which touches the fish; and a stroke of one of the largest kind, if properly applied, would

prove instant death to even the human species. This extraordinary power is given to this fish, not only for defence, but subsistence. For whenever small fishes or worms are thrown into the water, they are first struck dead by the electrical power of the animal, and afterwards swallowed by him.

M. Humboldt gives an interesting account of the manner in which they catch these creatures, by what they call "fishing with horses." After having scoured the Savannah, and caught about thirty wild horses and mules, they drove them into the pool in which were the electrical eels. The extraordinary noise caused by the horses' hoofs makes the fish issue from the mud and excites them to combat. These yellowish and livid eels, resembling larger aquatic serpents, swim on the surface of the water, and crowd under the bellies of the horses and mules. A contest between animals of so different an organization furnishes a very striking spectacle.

The Indians, provided with harpoons and long slender reeds, surround the pool closely; and some climb upon the trees, the branches of which extend horizontally over the surface of the water. By their wild cries and the length of their reeds, they prevent the horses from running away and reaching the bank of the pool. The eels, stunned by the noise, defend themselves by the repeated discharge of their electric batteries. During a long time

they seem to prove victorious. Several horses sink beneath the violence of the invisible strokes, which they receive from all sides in organs the most essential to life, and stunned by the force and frequency of the shocks, disappear under the water.

Others, panting, with mane erect and haggard eyes expressing anguish, raise themselves and endeavor to flee from the storm by which they are overtaken. They are driven back by the Indians into the middle of the water; but a small number succeed in eluding the active vigilance of the fisherman. These regain the shore, stumbling at every step, and stretch themselves on the sand, exhausted with fatigue, and their limbs benumbed by the electric shocks of the gymnoti.

"In less than five minutes two horses were drowned. The eel being five feet long, and pressing itself against the belly of the horse, makes a discharge along the whole extent of its electric organ. It attacks at once the heart, the intestines, and the *plexus cœliacus*, or abdominal nerves. It is natural that the effect felt by the horses should be more powerful than that produced upon man by the touch of the same fish at only one of his extremities. The horses are probably not killed, but only stunned. They are drowned from the impossibility of rising amid the prolonged struggle between the other horses and the eels.

"We had little doubt that the fishing would

terminate by killing successively all the animals engaged; but by degrees the impetuosity of this unequal contest diminished, and the wearied gymnoti dispersed. They require a long rest, and abundant nourishment, to repair what they have lost of galvanic force. The mules and horses appear less frightened; their manes are no longer bristled, and their eyes express less dread. The gymnoti approach timidly the edge of the marsh, where they are taken by means of small harpoons fastened to long cords. When the cords are very dry, the Indians feel no shock on raising the fish into the air. In a few minutes we had five large eels, the greater part of which were but slightly wounded."

THE END.